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ABSTRACT

This guide for starting a school garden is Book One in Project Life Lab's (Santa Cruz, California) three-part curriculum for a garden-based science and nutrition program for grades 2-6. The curriculum is designed for use as an integrated program, but the books can be used independently. It is suggested that the use of student journals can greatly enhance the effectiveness of the curriculum by providing a place for students to record data and observations as well lessons. Divided into three sections, this book covers: (1) planning, preparing, and sowing the garden site; (2) creating support for the project from teachers, students, parents, and the school administration; and (3) a step-by-step approach to the fundamentals of gardening. Each lesson in the third section provides the stated purpose of the lesson, a list of all necessary materials, the type of activity to be carried out along with needed background information, discussion questions for tying the lesson together, and additional activities and follow-up lessons. An eight-item bibliography of additional resources is included at the end of section one of this book. (JW)

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PROJECT OVERVIEW

CATALOG NUMBER: FP 000 359

PROJECT TITLE: Life Lab (2-6)

LOCAL EDUCATIONAL AGENCY:

Live Oak School District

ABSTRACT:

Life Lab is a science and nutrition program which facilitates critical thinking and academic learning as applied to an indoor or outdoor laboratory site. The laboratory allows students to apply concepts in science: problem solving/communication; awareness/discovery; soil; growing; photosynthesis; cycles and changes; interdependence; insects, flowers, and pollination; energy; and recycling. Concepts in nutrition are not only learned but also integrated with student eating habits as the students apply units in food choices, basic 4 food groups, nutrients, digestion, consumerism, and recipes. The curriculum, entitled The Growing Classroom, consists of three books. Book 1 is a guide to starting a school garden. Book 2 contains the ten science units listed above. Book 3 is the nutrition curriculum. The curriculum is best used as an integrated program; however, the books can also be used independently with success. Teachers with little background in science and nutrition find the activities easy to teach.

ADDRESS:

Project Life Lab
966 Bostwick Lane
Santa Cruz, CA 95062

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- Demonstration Programs
- Environmental Education
- Interdisciplinary Approach
- Learning Laboratories
- Nutrition Instruction
- Outdoor Education
- Sciences

TARGET GROUP(S):
- Elementary School Students
- Elementary School Teachers

TEACHING METHODS:
- Discovery Learning
- Experiential Learning
- Group Instruction
- Interdisciplinary Approach
- Learning Laboratories

LEARNING ACTIVITIES:
- Gardening
- Health Activities
- Outdoor Activities
- Science Activities

PROJECT MATERIALS:

Catalog Number	Title	Site
FD 002 112	The Growing Classroom Book 1: Becoming a Farmer (2-6)	C/N/S
FD 002 113	The Growing Classroom Book 2: Science (2-6)	C/N/S
FD 002 114	The Growing Classroom Book 3: Nutrition (2-6)	C/N/S

DA
5/83

THE GROWING CLASSROOM

A Garden-Based Science and Nutrition Curriculum

For 2nd through 6th Grades

Roberta Jaffe
Director

Margaret Cadoux
Garden Manager

Gary Appel
Science Coordinator

Kate Murray
Illustrator

developed by

Project Life Lab
Live Oak School District
Santa Cruz, California

validated as exemplary by:

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California Department of Food & Agriculture

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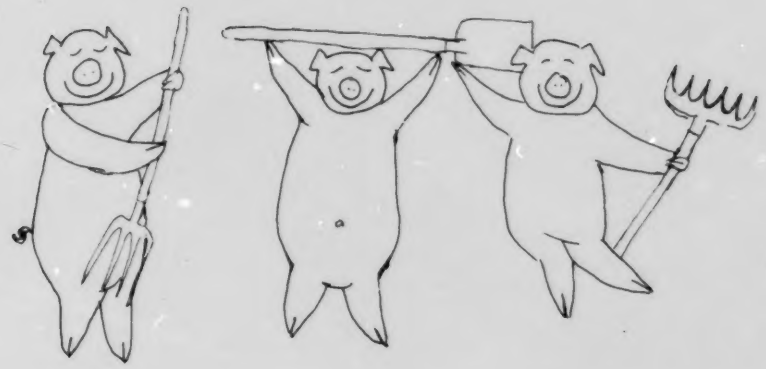

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Friends of the Harvest
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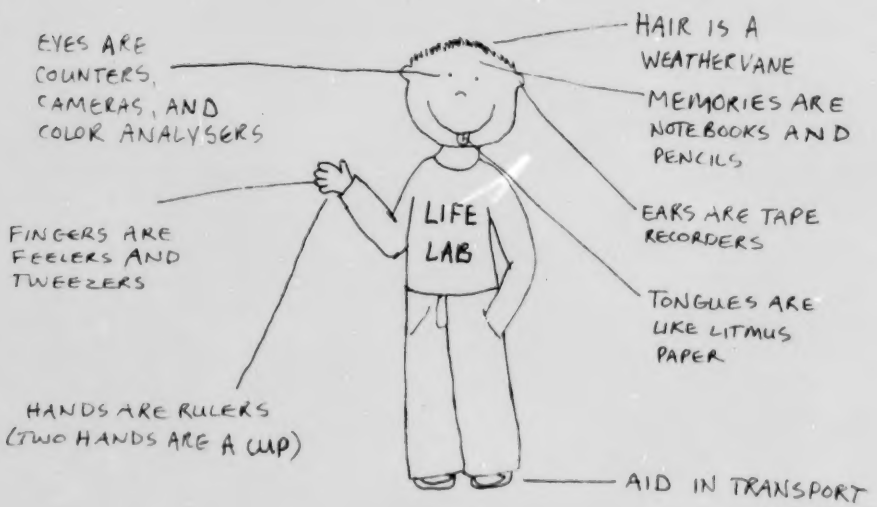
Santa Cruz, California
95062

DEDICATED TO

George Buehring

and

Our Kids (The Walking Laboratories)


EYES ARE COUNTERS, CAMERAS, AND COLOR ANALYSERS
HAIR IS A WEATHERVANE
MEMORIES ARE NOTEBOOKS AND PENCILS
LIFE LAB
EARS ARE TAPE RECORDERS
FINGERS ARE FEELERS AND TWEEZERS
TONGUES ARE LIKE LITMUS PAPER
HANDS ARE RULERS (TWO HANDS ARE A CUP)
AID IN TRANSPORT

Kid (Homo Sapiens): Belonging to many different families. Found in all parts of the world and in many different environments. Grows right before your eyes. Recently, they have been found more often in gardens. Kids can be both beneficial and detrimental to garden areas, but the benefits far outweigh the detriments. Males and females of the species (sometimes called boys and girls) differ slightly physiologically and occasionally otherwise, but have much the same appearance and benefits. Kids are particularly nice to have around Project Life Lab for they add to the richness of the garden and are the most beautiful crop around.

(written by Mary Cunningham)

ACKNOWLEDGEMENTS

Many people and organizations have contributed valuable time and creative energies to the development of Life Lab. We wish to thank them -- with special thanks to the David and Lucille Packard Foundation, the S. H. Cowell Foundation, California Department of Food and Agriculture, and Friends of the Harvest for supplemental funding.

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FOREWORD

With Project Life Lab's garden-based science and nutrition curriculum, your students will discover the wonder and excitement of scientific inquiry as the outdoors becomes their classroom.

These tested materials can help your school in many ways. Teachers will find practical and fun scientific projects interesting to their elementary students. Principals will find an improvement in the school climate along with the increased joy in learning. And students will find success in science while learning about themselves and the world they live in.

The preparation provided by Project Life Lab will serve your students well. The skills they learn today will help strengthen their educational careers for many years to come.

Ann M. Leavenworth

Ann Leavenworth, Ph.D
President
California State Board of Education

PREFACE

Drop by Project Life Lab at Green Acres Elementary School in Santa Cruz any weekday, and here's what you might find: fourth graders proudly graphing the growth of their tomato plants in the solar greenhouse; beaming third graders collecting and weighing eggs from their resident hens; fifth graders attentively taking the temperature of their compost heap; boys removing freshly baked cookies from their solar oven; girls carefully testing their garden soil for nitrogen and phosphorous; students eagerly harvesting carrots from their class garden beds for a nutritious snack; and much, much more.

Three years ago you would have found a parking lot here. Now it's a place where children grow. What began as a small recreational garden has evolved into an exciting outdoor classroom; a place where students apply what they learn; a place that excites students about the learning process; an environment where students can think and feel; and a setting that transforms teaching into a joyful activity.

Could this be your school? Can you do it? Based on the work of our teachers and those at three other schools implementing Project Life Lab, we're sure that you can. It's being done on three acres of a school site; it's being done on a 20' x 30' plot of playground; it's being done in planter boxes outside a classroom door -- And it works.

Read this guide for a garden based science and nutrition curriculum -- then give us a call. We'll help you get started planting the seeds....for your "Growing Classroom".

Project Life Lab
966 Bostwick Lane
Santa Cruz, CA
95062

(408) 476-0319

Gary Gappel Margaret Cadoux Roberta McJaffe

HOW TO USE THESE BOOKS

This curriculum has been prepared as a tool for teacher use in developing a garden-based science and nutrition program. It is divided into three books for easy use. All sections and units are identified with a salmon-colored cover page. The pages of the three books are numbered in sequence to facilitate cross-referencing.

Book One is a guide to starting your school garden. It consists of three sections:

Breaking Ground
Cultivating Support For Your Growing Classroom
Basic Gardening and Experimental Beds

Book One contains a Table of Contents for all three books. In addition, Books Two and Three have individual Table of Contents.

Book Two contains the Science Curriculum. It is divided into ten units:

Problem Solving/Communication
Awareness/Discovery
Soil
Growing
Photosynthesis
Cycles and Change
Interdependence
Insects, Flowers, and Pollination
Energy
Recycling

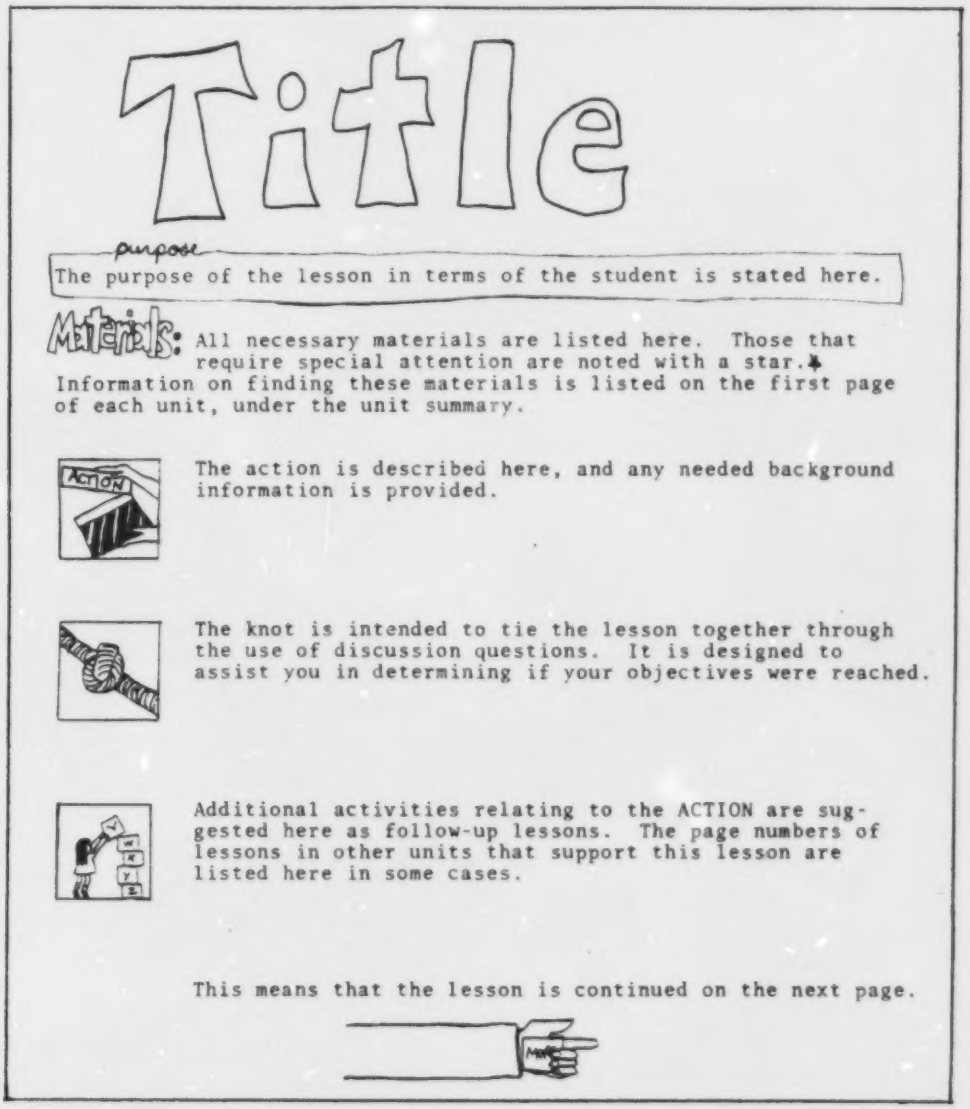
Book Three contains the Nutrition Curriculum. It is divided into six units:

Food Choices
Basic Four
Nutrients
Digestion
Consumerism
Recipes

The Science, Nutrition, and Gardening Curriculum is best used as an integrated program. The books can also be used independently. For example, you may choose to use the Nutrition book, foregoing the Science and Gardening books. Or you may simply use the Gardening book and start a class garden. Thus, you can develop your program one step at a time.

The salmon-colored cover pages of the Garden, Science, and Nutrition Curriculum units include: the unit title, a brief unit summary, titles of that unit's lessons, recommended grade level for specific lessons,and a list of places to find a few special materials.

Each of the lessons is presented in a similar format. The lesson format is presented below:


Title
purpose
The purpose of the lesson in terms of the student is stated here.
Materials:
All necessary materials are listed here. Those that require special attention are noted with a star.
Information on finding these materials is listed on the first page of each unit, under the unit summary.
ACTION
The action is described here, and any needed background information is provided.
The knot is intended to tie the lesson together through the use of discussion questions. It is designed to assist you in determining if your objectives were reached.
Additional activities relating to the ACTION are suggested here as follow-up lessons. The page numbers of lessons in other units that support this lesson are listed here in some cases.
This means that the lesson is continued on the next page.

In addition, use of a student journal can greatly enhance the effectiveness of this curriculum. Journals can serve as both a place for students to record data and information regarding their experiments, and as a focus for feelings and observations. The more kids explore their world, the more they want to communicate the results of their explorations. Capitalize on this through use of the journal. It is referred to in many lessons.

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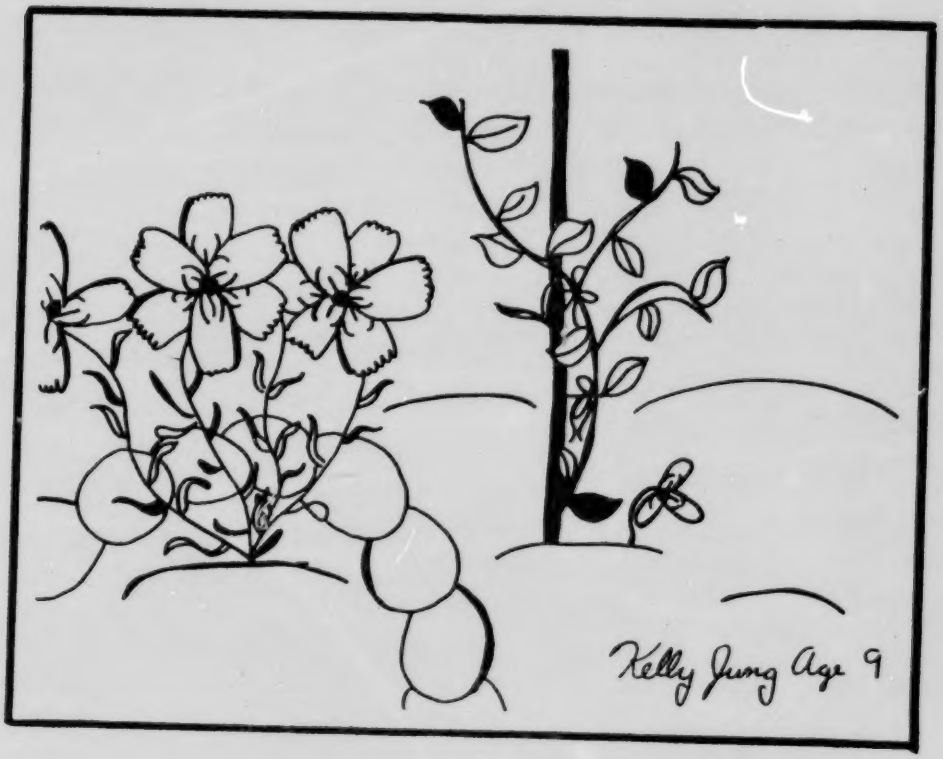

Kelly Jung Age 9

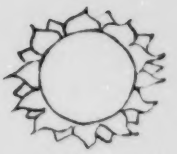
BREAKING GROUND

INCH BY INCH
ROW BY ROW
I'M GONNA MAKE THIS GARDEN GROW
ALL I NEED IS A RAKE AND HOE
AND A PLOT OF FERTILE GROUND

INCH BY INCH
ROW BY ROW
GOD BLESS THESE SEEDS I SOW
PLEASE KEEP THEM SAFE BELOW
'TIL THE RAINS COME A TUMBLIN' DOWN

INCH BY INCH
ROW BY ROW
GONNA MAKE THIS GARDEN GROW
GONNA MULCH IT DEEP AND LOW
GONNA CHANGE THE WORLD.

-DAVE MALLETT



WHOEVER HEARD...
of converting a 3-acre dirt parking lot into a lush garden? We did it. And slowly. As we stared at our red compacted subsoil, a garden just didn't seem possible, but it was. One step at a time.

You Don't Need Three Acres

If you don't have land, or can't start your garden outdoors, cultivate your classroom! Many of our lessons can be done easily in an "indoor garden". It's easy to grow plants indoors.

Follow the procedure detailed in Sowing the Seeds (p.11) and sow flats right in your classroom. (You could store your soil mix in a trash bin.) Seedling flats could be kept in a sunny window or moved outside during the day. Just remember to water them!

Transplant your seedlings into a planter box (or you could sow seeds directly into the box). The planter box should be kept in the sunniest part of the room (or outdoors, if the weather is mild). We've included plans for a simple planter box on p. 35.

Fill the box with a fairly rich mix: use our flat soil mix (p.68) as a base, and add more compost, bone meal, and old manure if you have it. Think of the flat soil mix as breakfast (a light meal for young plants) and the planter box mix as dinner (a heavier meal for older plants). If you sow peas, beans, tomatoes, or other climbing plants, put your planter box next to a fence or near posts connected with wire or string. That way your climbers can grow up the fence.

You can grow virtually anything in planter boxes, from parsley and lettuce to tomatoes and zucchini. Since many fruiting crops like zucchini need pollinators in order to produce fruit, they should be kept outdoors during the fruiting stage. If the boxes must stay inside you'll have best luck with root crops, like carrots, or leaf crops, like spinach and lettuce. Experiment! See how much of the outdoors you can bring into your "growing classroom".

Site Selection

If you have land available, choose the area that would be the best location for a garden. Garden anywhere! Even the smallest area will yield a surprisingly big harvest. The main consideration in your selection is the amount of sunlight; the area should receive at least 6 hours of full sun a day. You'll also need access to water. If you have found a good spot, but the soil looks terrible, don't worry about it! Even terrible soil can be made fertile over time.

Another unfortunate consideration is protection from vandalism. Is your garden spot protected or fenced off in any way? If not, there are other ways you can try to limit vandalism:

1) Hire a caretaker. That's what we did, and it's worked very well. In exchange for a free place to park their trailer, the caretakers watch out not only for the garden, but for the entire school grounds.
2) Locate your garden out of sight.
3) Make friends with the people who live near your garden. They can help keep an eye out for trouble.
4) Pick your vegetables often, especially the popular ones like tomatoes and peppers.

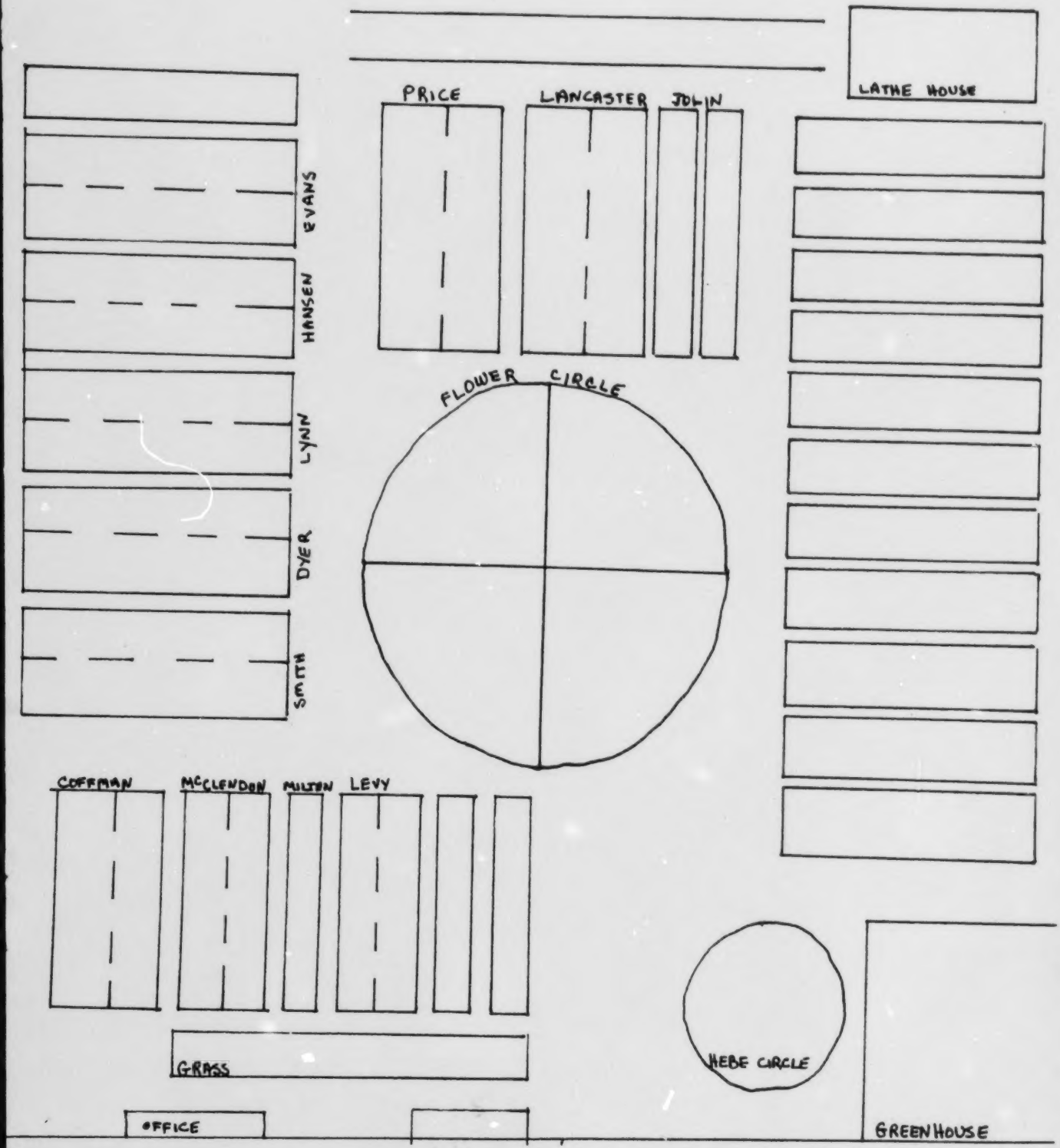
Now that you've picked your site, decide on a layout. Where do you want your permanent structures, like a greenhouse, cold frames, or tool shed? Make sure your greenhouse site will get maximum sunlight, but that it won't shade your garden beds.

On the next page is a map of our garden layout. Every week we make notations on a copy of the map about specific work that needs to get done. This system has worked well in helping us keep the garden work organized.

If you're on a large site like ours, don't be overwhelmed. We started with 6 small beds and grew to fill our 3 acres -- but it took us 3 years! Make sure to take a picture before you start your garden. Later on you'll be amazed at how far you've come.

WEEK OF _____

PROJECTS THIS WEEK: _____



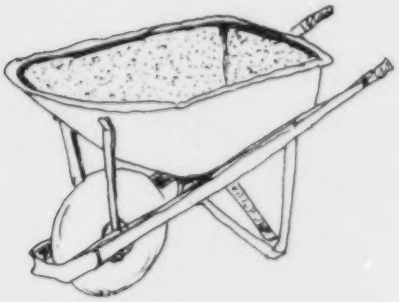
Test Your Soil

Soil testing will give you a clear idea of what nutrients you need to add to your garden. The soil test results -- from a local soil testing laboratory -- will tell you what nutrients may be low, how acid or alkaline your soil is, and what type of soil you have.

To take a sample for testing, dig several trowels full of soil from the top six inches in many different areas of your garden. Combine them in a pail and take a composite sample from there. Send it for testing or use a kit and test it yourself. (For an elementary soil test lesson, see p.133.)

An important aspect of your garden soil is its pH and where it falls on the acid-alkaline scale. On the pH scale, which ranges from 0-14, the most acid substances are near 0, and the most alkaline near 14. Seven is neutral. Garden soils usually fall into the 4.5 to 8.5 range on the pH scale, and they do change over time. Different vegetables prefer different pH levels, but most do well in the 6.0 to 6.8 range.

If you need to raise the pH of your soil, you can raise it by one pH point by applying lime (approximately 4-5 lbs/100 square feet). If you need to lower it, add a lot of compost and manure.



How Do We Involve The Students?

At Life Lab we give each class of approximately 30 students two garden beds (each 25' x 3½'). Those two beds become the responsibility of that class: they dig and prepare it, sow it, weed and water it, and harvest it.

In addition, we felt it was important to have communal areas where children from different classes and grades could work together on a project. Communal areas at Life Lab include our flower circle, raspberry patch, and orchard. Further, the seeds sown in the greenhouse are used in all the beds.

There are many ways to organize the use of your garden. The entire garden could be worked communally by all the children, or each child could have their own small plot. But I can vouch for our system! It's worked well for us.

Tools

Before you can start digging, you'll need tools! The quantity will obviously vary with your budget and scale of operations. But try not to skimp on quality! "Quality" and "expense" may seem to go hand-in-hand, but this isn't always the case. Inexpensive tools may not end up as a bargain. Don't confuse quality with weight; good lightweight tools will make gardening easier for you and the students. Good quality tools cost more, but they usually last longer and do a more efficient job. If you're on a tight budget, you might check your local flea market and garage sales for bargains.

You'll need spades and spading forks to dig the beds with. The spading fork, with its sturdy, flat prongs helps you cultivate a little deeper, and to break up clods in the topsoil. You'll find the "D" short-handled tools are easier for the students to handle.

Other necessary tools are: iron rakes to break up dirt clods, remove rocks, and level seed beds; hoes for making furrows, weeding and cultivating; shovels to handle compost and other amendments. A wheelbarrow will be a big help in transporting materials.

Of course you'll need watering cans or hoses, and a spigot to attach them to! If you're using hoses, we recommend a fine-spraying fixture for seedlings. The one we use is called a fan sprayer. It allows you to water your seedlings gently, mimicking a soft spring rain.

Add to this stakes, twine or string, measuring tape and hand trowels, and you're ready to go! At harvest time you'll appreciate owning a sharp knife and harvest basket.

Set up a tool cleaning box near your tool storage area. Fill the box with sand with some old motor oil mixed in. Have students

clean their tools with a wire brush, then dip in the sand/oil box before returning the tool to the shed.

Tool Checklist

Spades
Spading forks
Iron rakes
Hoes
Shovels
Wheelbarrow
Watering cans
Hose
Fan spray hose attachment
Stakes
Twine (or string)
Hand trowels
Knives
Harvest basket
Tool cleaning box
Wire brush

Preparing The Site

At Life Lab, our soil was so compacted that we decided to break it up initially with a tractor; then we proceeded to dig our beds. Hopefully your soil is a bit better, and you can start digging right away.

The ground should be somewhat moist, but not sopping. If mud is sticking to your boots, it's too wet to dig! On the other hand, if it's dry, you can water it with a sprinkler for several hours and let the area sit for a day or two while the water percolates down. Then give it a try. To test for proper soil moisture, squeeze a ball of earth together in your hand. It should keep its shape when you open your hand, but also crumble when touched.

Now you're ready for action! The first thing to do is stake off your garden beds with stakes and string. Beds can be whatever length you please, but width should be no greater than 4'; greater than this and children will not be able to reach to the middle of the bed. Our beds are approximately 3½' x 25'. At two beds per class of 30, that area (approximately 180 square feet) works out about right. We leave 3 feet between beds for paths -- a nice wide open space, ample room for kids to accidentally dump wheelbarrows of compost!

Once the beds have been staked off, the digging begins! (See our lesson on double-digging, p. 65 for a detailed description of the method.) The deep-bed method of double-digging allows you to grow a lot more in a small space. The essence of the method is to dig deeply and then never tread on the bed. This means your plants are growing in very loose, deeply dug soil. Since their roots will then tend to go down instead of sideways, you can get bigger plants and grow them closer together. A deep bed should produce about four times the yield by weight that a conventional bed will produce; a deep bed of 100 square feet can produce from 200 to 400 lbs. of vegetables a year.

So with that as inspiration, dig away!

Sowing The Seeds

Now that your beds are being prepared, you're going to need plants to put in them! It's possible to go to a nursery and buy "six-packs" of plants, but this is a very expensive way to operate.

Better yet, sow your own seeds! Whether you sow your seeds in a flat indoors, or direct in the ground outside depends on the type of plant and the time of year. We've provided a chart that will give you a rough idea of the culture of certain vegetables (sown in a flat or directly in a bed; warm or cool weather; planting distances, etc.)on p. 36.

But what is appropriate for coastal California may not be right for your area! The best idea is to consult your local agricultural extension office (see the phone book under County Government listings) for a chart of recommended planting times and successful crop varieties.

Where do we purchase the seeds?
Most hardware stores carry seeds, but a local nursery is bound to have greater variety. A cheaper way to get seeds is to purchase them in bulk directly from seed companies. All you have to do is write them for their free catalogues, decide what seeds you want and in what quantities, and mail back your order. Usually you will receive your seeds within six weeks. So when you order, think ahead! What seeds will you want to sow a few months from now? Make sure to include those, too, in your order.

Here is a list of some seed companies. Some, like Burpee and Parks, are very large companies with a great selection of popular varieties. Others, like Johnny's in Maine, are smaller operations that often carry interesting and uncommon varieties. Smaller companies tend to let you order in smaller quantities, which has been an advantage for us.

Seed Companies

* Johnny's Selected Seeds
  Albion, Maine 04910

* W. Atlee Burpee Company
  Riverside, CA 92502

* George Park Seed Company
  Box 31
  Greenwood, SC 29646

* Stokes Seeds, Inc.
  Box 548, Main P. O.
  Buffalo, NY 14240

* Nichols Garden Nursery
  1190 North Pacific Hwy.
  Albany, OR 97321

* Thompson & Morgan, Inc.
  Box 24
  401 Kennedy Blvd.
  Somerdale, NJ 08083

Another possibility is to write or call seed companies and check for old seed. Nurseries must send the year's unsold seed back to the seed companies in December of each year. It is possible that the seed companies will be willing to donate that seed to your worthy cause!

What do we do with the seeds once we have them?
Check the planting guide, p. 36. If it's appropriate to sow them direct in the garden bed, prepare your beds (see Preparing Your Garden Bed, p. 15) and sow away!

But some seeds will have to be started in flats, and later transplanted into the ground. There are many household items that can be used for seed flats: egg cartons, tofu containers, milk cartons (cut to 3" in height) -- almost anything! Just make sure there's little holes in the bottom for water drainage. You could also check nurseries for old or discarded flats. That's how we started.

Ideally, you should make your own permanent flats. It's really easy to do, not very expensive, and much more efficient in the long run. The flat design we use is detailed on p. 34 .

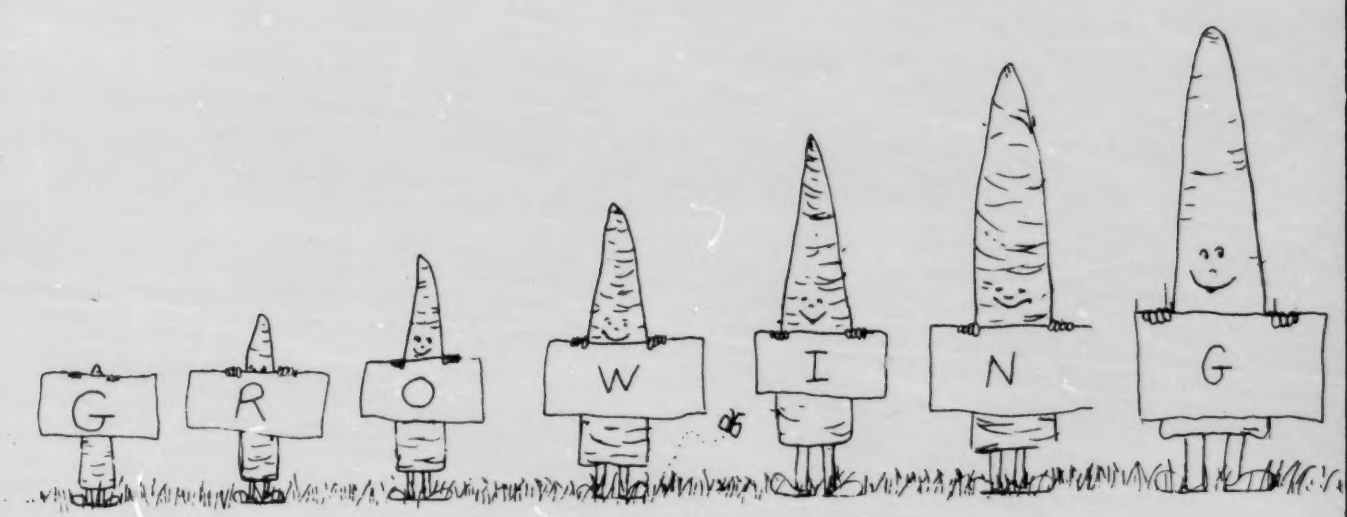
If you are sowing in flats, you'll need to make up a flat soil mix. For details, see our seed sowing lesson on p. 68. However in the beginning it might be easier to buy a pre-made soil mix. The mix (or its components) can be stored in old trash cans, or bins of any type.

How do we care for our seedlings?
Newly sown flats should go into your greenhouse or classroom. Don't let them dry out! As seeds don't need much light to germinate, you don't have to keep them in a sunny spot. But once their cotyledons (first leaves) have peeked their heads above the soil, put the flat into a sunny spot right away! Otherwise they'll soon become long and spindly as they search for the sun.

Let the seedlings grow in the flat until their first true leaves emerge (the set of leaves after the cotyledons), and/or they become overcrowded in the flat. Generally this will take one to two months from seed. Transplant into another flat or directly into the ground. For details, see the transplanting lesson, p. 70 .

Before you set your transplants into the ground, help the plants get used to their new, harsher environment by "hardening them off". This involves setting the flat outdoors during the day starting about one week before transplant. Then leave them out all night

2 or 3 days before they're to go into the ground. When it's time to transplant, you'll have healthy, conditioned plants to put in the garden.



Preparing Your Garden Bed

Before seeds or seedlings can go in the ground, the beds must be prepared for them. Once the beds are dug, they should be fertilized, so that the growing plants will have plenty of food.

At Life Lab we ruled out using chemical fertilizers for several reasons: they are expensive; they contribute nothing to the structure and life of the soil; their production is oil-based and energy intensive. Further, we feel that recycling through composting is more instructive about life cycles than importing our fertilizer.

There are many organic materials (or amendments) you could apply to your soil. People have used an amazing variety of amendments. We'll give you a personal example: two years ago a huge school of anchovies got caught in our harbor and died. In addition to the bad smell, oils from the anchovies were corroding the paint on all those expensive boats. So there was an intense community effort to clean them out and dump them.

But to us at Life Lab, this misfortune represented unparalleled opportunity! Those fish were full of trace elements (particularly phosphorus) that are plentiful in the ocean but not on land. With visions of lush tomato plants and delectable corn, we brought our truck to the harbor and scooped up thousands of anchovies. We made a compost pile with them (and lots of straw) and applied our "fish compost" to the soil a few months later. Never mind that it took 3 or 4 washings to get that odor of anchovies out of our clothes!

We have provided a list of more common organic amendments on the next page. You will probably find that you can get many for free; many horse stables, for example, are only too happy to get rid of their manure. (Note: sawdust is usually readily available, but we avoid using it because it robs the soil of nitrogen.) But you will need a truck to be able to go on these fertilizer missions.

When we prepare a bed here, we usually apply compost and bone meal (a source of phosphorus and calcium). Compost is applied liberally, bone meal is lightly sprinkled on. In addition to our home-made compost, we also apply mushroom compost, a reasonably priced fertilizer we can get in bulk. Sometimes we also apply old (at least six months) horse manure. Fresh manure is hot as it breaks down and could burn the plants. We then work the amendments into the top several inches of soil using our spading forks. As we fork, we try to expose large clods or rocks to the surface. Then we gently rake the bed, bringing the clods or rocks into the paths, but trying not to remove any soil. As you rake, try to keep the bed curved in shape. This will improve the drainage of water, as water tends to sit on a flattened bed.

Once the bed is prepared, you're ready to go!

ORGANIC FERTILIZER SOURCES

Material	Natural Source Of
Blood Meal	Nitrogen
Cottonseed Meal	Nitrogen
Fish Meal	Nitrogen
Hoof & Horn Meal	Nitrogen
100% Chicken Manure (Aged & Dried & Bagged)	Nitrogen
Other Manures	Nitrogen
Bone Meal	Phosphorus
Phosphate Rock	Phosphorus
Green Sand	Potash
Kelp Meal	Potash
"Clodbuster"	Humic Acid
Wood Ash	Potash

Composting

Composting is a safe, economical, ecological reuse of resources. The temperatures reached by an aerobic (aerated) compost pile (up to 160°F) are high enough to kill off many weed seeds and pathogens. Making compost is easy, and it provides you with a free source of fertilizer as well as an excellent soil builder. Composting happens almost everywhere in nature as a means of replenishing the soil.

When you build a compost pile, you are promoting the biological decomposition of organic matter under controlled conditions. This decomposition is done for the most part by microorganisms, primarily bacteria, fungi, and actinomycetes. They break down highly organized matter into smaller, simpler molecules that become available as nutrients for your plants. It is their activity which heats up the compost pile.

Composting allows the children to see that what we call "waste" is often nutrients in disguise: things they normally throw away can be thrown into a compost pile and retrieved a few months later as fertilizer. Encourage students to bring out their extra school lunch "waste" to dump into a plastic bucket (with a tight-fitting lid) and add a layer of sawdust. Contents of this bucket can then be added to the pile as it is built.

There are many ways to make compost. There is a "slow" and a "fast" method. The "fast" method provides compost in two to three weeks. You build the pile as you normally would, but you must turn it every few days (so that the outside of the old pile is the inside of the new pile) to speed up the breakdown. This method is labor-intensive, but is advisable when you are just starting a garden. For a complete, detailed description of the "fast" method, see the Farallones Integral Urban House, pp. 127-140.

At Life Lab we tend to rely on the "slow" method, which takes 4-6 months to produce a usable product. We accumulate weeds,

lunch wastes, manures, and other organic matter for about a week, and select a composting day. The pile does not have to be completed that day, but can be capped with straw and finished the following week. The compost pile can be built anywhere, but ideally the compost area should be accessible to pick-up trucks bringing in manure, straw, or other materials.

What do we need to make compost?
You will need tools. Each child should be equipped with a hay fork or digging fork, and there should be shovels available for manure. You should have a hose on hand with a fine spray attachment to water the layers as you go.

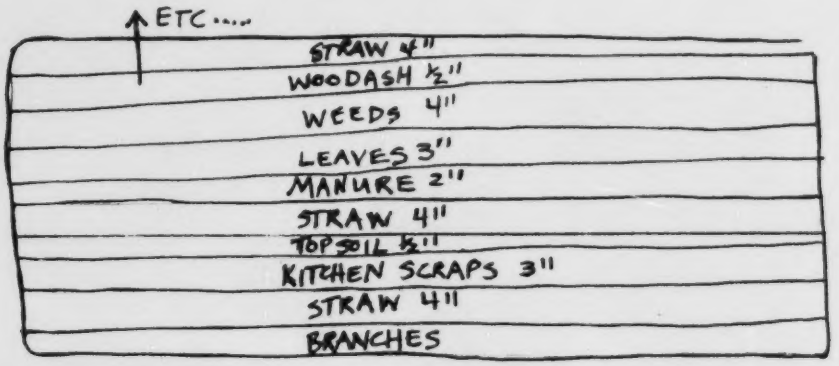
What to compost? Any decomposable organic material, or any material derived from something previously alive. For example: all kitchen wastes and crop wastes, garden debris, manures, straw, etc. Manures are excellent in heating up a compost pile. Do not include: human feces, diseased animals, plants treated with pesticides, or any toxic materials. Materials that you are not sure of (because of high acidity or harmful secretions, for example, like pine needles or eucalyptus) can be added in moderation.

Be on the lookout! There's all kinds of free organic matter lying around going to waste. Check stables for manure and straw, restaurants and grocery stores for food wastes.

How do we build the pile?
Compost is made by layering different materials in 2-3" layers. Alternate "dry" (carbon) material with "green" (nitrogen) material. (Manures are included in the nitrogen category.) Some examples of dry material are: dried grass or weeds, hay, sawdust, straw, branches, etc. Some examples of "green" material are lawn clippings, leaves, stems, roots, manures, kitchen garbage.

Be creative! Almost anything can be composted. The layering process is described in our Compost Lesson, p. 71 .

In the end, your pile might look like this:



The pile should be at least 3' high, and capped with straw.

Some considerations in building the pile.

*Size of the pile. One cubic yard is the minimum size. At this point it is self-insulating. Any smaller and the pile will lose too much heat, nitrogen, and moisture. Maximum height is 5'-6'. Any taller than this and the pile will become too compressed and be deprived of air. Width and length of the pile are variable.

*Aeration. This is important to watch out for, especially in rainy seasons when rain can compact the pile. The best way to insure the presence of air is to incorporate "air layers" -- layers of thin, decomposable twigs, stalks, or straw, or other somewhat bulky, fluffy material.

*Shape. The pile should be made in a rectangular shape. This is assured only by constantly forking material out to the corners and edges. Unless they are built up, the pile will become a giant pyramid, which will lose more heat, moisture and nitrogen than a rectangular pile.

*Size of composting materials. Very large items will not break down. Chop them up a bit with a sharp spade on the ground before adding to the pile.

*Moisture. This goes hand-in-hand with aeration. The pile must be moist, but not sopping. If it is too wet and there is not

enough air, compost will have a foul smell. If this happens, turn the pile and add materials to soak up the moisture (straw or sawdust). If rain is a problem, you can put a roof over your compost area, or round off the top of the pile so it sheds water.

*Carbon-nitrogen ratio. This should be maintained at roughly 25:1 or 30:1. It's not as complicated as it sounds, and will be maintained naturally in the layering process. Some common carbon-nitrogen ratios are: raw garbage 25:1; sawdust 400:1; farmyard manure 14:1.

How do we work the kids into this process?

As they help build the pile, let each kid have a turn watering it (watering should go on constantly during compost-making unless all materials are sopping) and directing the activity. This means helping figure out which layer to put on next, telling others to remember to build up corners and edges, etc.

Follow up the compost activity with these ideas:

*Put a hot-bed thermometer 12"-15" into the pile, and carefully monitor the change in heat over the first few days. Let the kids graph it, and discuss why the heat is being produced (biological activity of the microorganisms). Don't we also make heat when we are active?

*Look through microscopes at a chunk of compost and observe all the life.

*Observe how the pile shrinks over time. Why does this happen? (As large chunks are broken down, there is less air space.)

*As they use the compost remind them that they made this nutritious fertilizer from "waste" that would have been thrown out.

When is our compost done?

In general, the pile has finished composting when the compost:

*has an earthy, humus-like odor

*has a dark brown color

*materials are not easily recognizable.

Check towards the interior of the pile (at least 6") for these

characteristics. The exterior will not be fully composted. This process will usually take from 4-6 months.

What do we do with the compost?
Compost is an excellent fertilizer. Every time you prepare a garden bed, work some (a 1"-2" layer) into the top few inches of soil. Or, if you are fertilizing a perennial plant (vine, shrub, tree, flower, etc.), carefully work in some compost around its roots and water it in. Be generous! There is no such thing as too much compost. It is an old adage that the less your soil looks like compost, the more compost you need to add.

Compost is also an excellent mulch to put in between your plants. It releases its water and nutrients to the soil much more readily than do some other mulches, like peat moss or bark.

Watering

In California we can't rely on rain to water our plants! As a result, California farmers and gardeners must put considerable thought into watering.

At Life Lab, we use a great variety of watering systems. Seed flats and seed beds are watered by hand with a hose that has a fine spray attachment (called a fan spray). We point it up in the air so that the water falls gently onto the seeds. Seed beds must be kept constantly moist or germiniation will be inhibited. But beware! It is possible to overwater. If you see a green mold developing on the flat or seed bed, let it dry out some and gently break up the moldy crust. (Note: if you can't be around to keep an eye on your seed bed, try covering it with wet burlap bags to keep it moist.)

Seedlings should also be kept fairly moist, though their need is not as critical as the seeds'. We water them in the same fashion, only deeper in order to promote deeper root growth.

As plants grow and mature, they need more water less frequently. Deeper waterings will allow their roots to travel deeper, which is beneficial for the growth of most plants. Plants that are watered every day develop shallow root systems that are more susceptible to sun-scorch, injury and drought. To determine if your garden needs watering, poke your finger into the soil a few inches. If the soil is dry, then your garden needs to be watered.

When school is in session, all the watering in the main garden is done by hand by the children. We explain to them that plants have different water requirements at different stages of their life cycle. Mature plants are watered to the base, either with a watering can or with a hose. We try to avoid getting water on their leaves as this tends to promote fungus.

The best time to water is in the early morning because plants utilize water best when the sun is out. Watering late in the day

may attract insects, give fungal spores a chance to germinate, and cause decay because plants won't dry out before nightfall.

During the summer, we have to rely on sprinklers. Sprinklers do the job adequately, but they are not as effective as hand watering because: 1) more water is wasted; 2) fungus growth is promoted; and 3) all plants receive the same amount of water, regardless of need. But if you have to use sprinklers, don't be daunted! The plants' mission in life is to grow, and grow they will.

You might also consider drip irrigation, which is becoming increasingly popular. It has all the advantages of hand watering, without the need for hands! At Life Lab we have installed drip irrigation on most of our perennials: fruit trees, raspberries, and strawberries. Drip lines are very simple to install. Drip irrigation allows you to simply turn a faucet and have the water delivered directly to your plants in slow drips. If you can afford the initial investment, it is well worth the cost. Call your local hardware store or farm-garden supplier for information.

Cover Cropping

Cover cropping is the practice of planting any area not in current production with plants which improve the soil. It is a simple and effective way of reducing soil erosion and simultaneously increasing soil fertility.

Because they fix nitrogen, legumes such as bell beans, alfalfa, fava beans, vetch, and clover are common and beneficial cover crops to increase the amount of nitrogen in the soil. Simply spread your seed, rake it in, water, and let it grow until it begins to flower. Cut the crop at the soil level, and compost the green matter. The roots that you've left behind can be tilled or dug into the soil. Though cover cropping is most commonly done in the winter months, you can sow a cover crop any time of the year.

It is also quite common with these same plants to practice what is called green manuring. Allow the plants to grow until they are almost mature, and then cut the plants down and chop them up with a shovel. The pieces of plant material can then be dug directly into the soil. The lush green growth is high in nitrogen and breaks down very rapidly. In a few weeks' time the bed will be ready for planting.

Grasses, such as buckwheat and rye are often grown as cover crop also. They have very long extensive root systems that are capable of bringing up nutrients from deep down that would otherwise be unavailable to most crops. They also aerate the soil and improve the drainage.

Whether you cover crop or green manure, you are doing much to improve the quality of your soil. Ask your local nursery or garden supplier to recommend a cover crop seed for your area. Then all you have to do is spread the seed!

(Adapted from Santa Cruz Community Gardens' Planting Guide)

Mulch

Mulch is a material applied on top of the garden soil during the growing season or after the harvest. Some common organic mulches are hay, straw, pine needles (for acid-loving plants), leaves, lawn clippings, and shredded bark. It is used to accomplish several things.

1) Mulch blocks out sunlight to prevent weeds from taking hold between plants.
2) Mulch helps conserve moisture. This is especially useful in dry, sandy soils, warm climates, and during droughts.
3) Mulch acts like a blanket to insulate the soil and keep the soil temperature more constant and cool. Over the winter a heavy layer of mulch insulates plants against severe freezes.
4) Mulch, particularly deciduous leaves and compost, can provide valuable organic matter to your soil when it breaks down.
5) Mulch, particularly shredded bark, can be spread in main garden paths to prevent them from being muddy in the winter and to keep down weed growth.

Mulching is usually a beneficial practice that helps the soil and eliminates some watering and weeding during the growing season. However, mulching can work to your disadvantage. If the growing season is especially wet, mulch helps retain water, preventing the soil from drying. This could cause a root rot and kill the plant. Further, mulch can provide a breeding ground for garden pests, particularly snails and slugs.

How much should you use? Generally, a mulch layer about three to six inches deep will do the job. It's preferable to apply mulch after it has rained, and you have cultivated. Applied at this time, mulch will help keep in moisture already in the soil, and not prevent the rainwater from getting through dry mulch which could absorb much of the water before it gets to the ground.

Sidedressing

Sidedressing is applying a small amount of fertilizer to your plants during the growing season. It is like a "second helping" when plants need it most. At Life Lab we use well-rotted manure or blood meal, work it in with a hand fork about the base of the plant, then water it in. We also use liquid fish emulsion for a sidedress fertilizer.

Many plants respond well to sidedressing, including

*Perennial herbs and flowers
*vine crops (cucumbers, squashes, melons)
*cole crops (broccoli, cabbage, cauliflower)
*tomatoes
*celery
*garlic and onions
*corn.

Weeds In The Garden -- Uninvited Guests

Weeds are simply plants that are where you don't want them to be. The main problem they present is competition with your crop plants for nutrients and sunlight. Cultivation (loosening or breaking up the soil around the plants) with a hoe can help keep them from getting established. Also mulching around your plants will discourage weeds by blocking sunlight from reaching the soil.

But unless you have a severe weed infestation, don't waste time worrying about them! The presence of some weeds can actually be beneficial to your garden, for several reasons:

1) Deep-rooted weeds bring up minerals from the subsoil, and make them available to other plants in subsequent growing cycles. Many of these weeds are trace mineral accumulators.

2) Weeds with powerful roots can break up soil hard pans and allow crop plants to spread and feed on the lower soil depths. Their roots also help aerate the soil.

3) Weeds conserve nutrients that might otherwise be leached, washed or blown away.

4) When composted or dug in, weeds add organic matter with a wide variety of elements.

5) Edible weeds can be excellent natural food.

6) Weeds often are the preferred food of insect pests. When you remove all weeds, many of these pests will tend to stay in the same area and feed on your crops.

So be selective in what weeds you remove. Keep them from interfering with your crop plants, but experiment by letting others grow. You may find they're not so "weedy" after all!

(Adapted from Santa Cruz Community Gardens' Planting Guide)

Keeping Your Garden Healthy

When you cultivate a plant, you cultivate the insects and diseases that go with it, too! Sometimes insect friends will take care of insect problems even before you know they're problems. Some natural predators and parasites are:

1) Lady bug/lady beetles. A prime predator of soft-bodied insects such as aphids, spider mites, whiteflies, mealy bugs, and the eggs and larvae of many other insects. You can order these beneficial insects from Rincon-Vitova Insectary, P. O. Box 95, Oakview, CA, 93022.

2) Green lacewings. Also a prime predator of the soft-bodied insects. These insects are very delicate with large pale green wings. They are also purchasable from Rincon-Vitova.

3) Ground beetles. There are a few species of black ground beetles that prey upon snail eggs. These beetles are dark with heads smaller than the rest of their bodies.

4) Spiders. Any and all spiders are terrific predators.

There are also some plants that are found to have some broad-spectrum insect repellent properties. These are: marigolds, asters, chrysanthemums, and many herbs, especially anise, coriander, basil, tansy, yarrow,and rue. Try interplanting these in your garden. You will also add color, and many of the herbs are useful in cooking.

There are easy preventive measures you can take to reduce pest problems:

1) Move or get rid of plants that for one reason or another don't do well in your garden. Weak and sickly plants provide a focal point for garden pest invasion which will eventually spread to even your healthy plants.

2) Grow plants that are suited to your topography, climate, and soil.

3) Keep your garden area clean! This cannot be stressed too much. Refuse from last year's crops provide the perfect haven for many garden pests, such as snails, slugs, and earwigs.

4) Avoid sequential planting of crops of the same family (e.g.,

potato and tomato) in the same soil.
5) Don't overwater, and try to water earlier in the day, keeping water off the leaves as much as possible. This helps prevent fungus.

But if damaging insects insist on feeding on your plants, there are some very simple means of controlling pests on a small scale:
1) Squash them.
2) Water -- at high pressure you can effectively wash off an insect population (such as aphids) and drown them in the process.
3) Herb sprays. Grind up some cayenne or garlic in your blender with water, and spray onto insects.
4) Detergents. 1 tablespoon detergent to one pint of water, thoroughly mixed, and spray onto the plant.

Specific Insects

*Aphids. Spray off with water at high pressure or use detergent spray.
*Slugs/snails. Sink a tin of beer into the ground, rim at ground level. Attracted to the yeast, these pests will crawl in and drown. A ring of wood ash around your beds will provide an effective barrier. Have kids collect them, and feed them to a friend's chickens or ducks.
*Earwigs. Trap earwigs under boards or in newspapers that have been rolled up and left out overnight. Or drive a wood stake into the ground, put a gunny sack on top and a flower pot on the sack to hold it down. The earwigs will hide there. Collect and destroy them, or feed them to the chickens.
*Caterpillars. Pick them off.

Larger animals can be garden pests, too. Birds are especially fond of fruits and berries, and young seedlings. You can cover these plants with bird netting for protection. Or try a scare-crow!

Fencing will offer some protection against deer or rabbits. But it will have to be awfully high to keep deer out -- and go about

a foot into the ground to keep rabbits from burrowing under!

Gophers are very difficult to control. We've tried various methods, and found that trapping them is the most effective one. Keep setting those traps! One gopher will soon give you an extended family.

(Adapted from Santa Cruz Community Gardens' Planting Guide)

Gonna Make This Garden Grow!

What we are really learning in the garden is how to observe. Each time you repeat a growing cycle you and your students will notice more and more about plants, their pollinators, growth habits, pest problems, and so on. At Life Lab we like to take weekly walking tours with the students and encourage them to make observations about the garden:

"Those plants need thinning!" Crops that are sown directly into the ground (like carrots, beets, and spinach) often need to be thinned out, or they will crowd each other. When we thin we try to remove the smaller, weaker plants to leave more growing room for the healthier ones. You may want to thin once when the plants are small, and again when they have grown and need more room.

"That bed is being eaten alive!" Well, what's eating it? Have students search for the culprits. They may not be able to find them; perhaps it was a rabbit that came by in the night, or earwigs that have gone into hiding during the day. Keep an eye on the plants, and once you've discovered the identity of your unwanted guests, ask your students to help decide how to control them.

"That zucchini is 2 feet long!" Make sure to keep your crop plants and flowers harvested. The purpose of plants in life is to produce seed, and if you don't harvest in time, they will begin to put all their energy into seed formation, not fruit or flower production. (For tips on when to harvest, see the chart on pp. 36-37.) So pick, pick, pick!

"That flower is all brown and dry!" Sometimes you may want to let plants go to seed, so you can collect and resow it. Saving plants for seed is a great way to complete the life cycle in your garden, and it saves you money. Virtually any plant can be saved for seed, except hybrids. Hybrid plants will not breed true; that is, their progeny will not be like them (check the seed package to determine if the seed is a hybrid). To save seed, wait until the seed pod is brown and dry (don't water the plant overhead), then cut off the seed head, shake the seeds into a brown

paper bag. Don't worry about mixing the chaff with the seed. Make sure you label them, along with the date collected. Now go ahead and sow what you have reaped!

"Our garden is beautiful!" At Life Lab we try to leave a space at the end of each garden bed for flowers or herbs. In addition we have special beds devoted to these plants. They add a visual, aesthetic richness to our place that everyone senses and enjoys. Everybody likes to cut flowers, and carry home some fresh oregano for their tomato sauce!

Cultivate a garden. No matter what its size or scale, you will be cultivating your students as well.

Final Checklist

* Site Selection
    - 6 hours full sun
    - water access
    - fencing

* Organization
    - designate garden beds
    - tool storage
    - watering responsibilities
    - seed-starting location

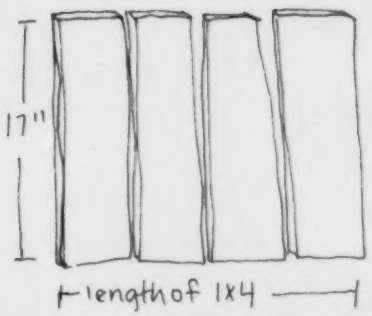
*Purchase
    - tools
    - seeds

*Gardening
    - plant seeds in flats
    - dig garden beds
    - add soil amendments
    - plant
    - water
    - harvest
    - compost

Flat-Making

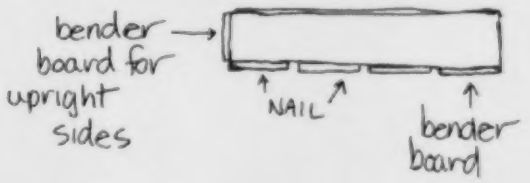
Materials (for 1 square flat)

- 6 pieces 17" long bender board (redwood bender board comes in approximately 3/8" x 4")
- 2 pieces 1" x 4" (Their length should be 4 times the width of the bender board plus 3/8 inch. Use fir or redwood)
- 8 penny galvanized nails



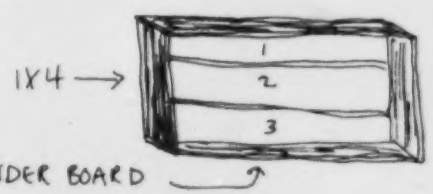
← VIEW OF BOTTOM 4 PIECES OF BENDER BOARD SIDE BY SIDE WITH 1/8 INCH SPACE BETWEEN

SIDEVIEW → OF BENDER BOARD NAILED FROM THE BOTTOM TO THE 1X4



☆NOTE: FOR RECTANGULAR FLATS USE 3 22" BENDER BOARD SLATS ON THE BOTTOM.

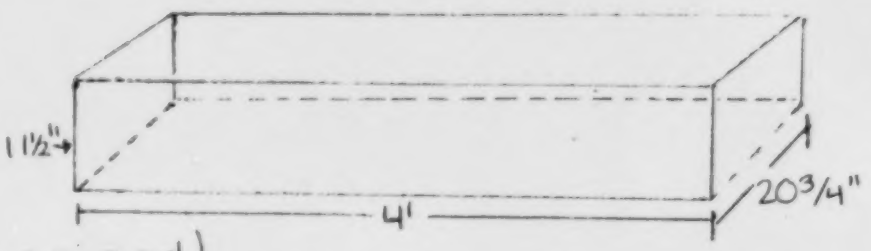
TOPVIEW ↘



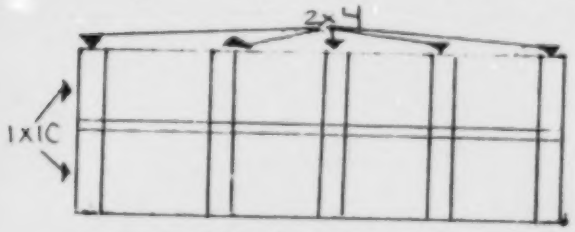
Plans For A Planter Box
4' Long x 11½" High x 20¾" Wide

① Materials - all lumber should be redwood otherwise it will rot.

2 4' 1x12
2 20¾" 1x12
2 4' 1x10
5 19" 2x4
8d nails (galvanized)

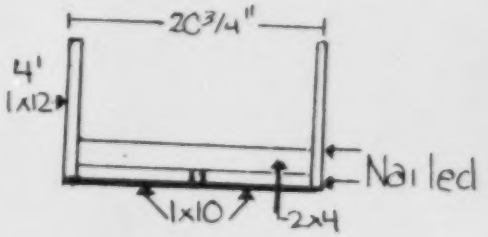


② Bottom
Place 2 1x10s next to each other with a slight space in between. Nail 2x4s to slats.



leave a small space between 1x10's for drainage (½" or less)

③ Side
Nail through the side, both into the bottom 1x10s and into 2x4s.



④ End
The last piece goes over the whole end. it should measure 20¾" wide but you should check the measurement first. Nail through end piece to existing sides and bottom.

Vegetable Planting Guide

Vegetable	Warm Weather	Cool Weather	Sow In Flat	Sow Direct	Distance Between Plants	Depth to Plant Seeds	Days Until First Harvest	Remarks
Bush Beans	X			X	6"	1"	50-60	pick every 3-7 days
Pole Beans	X			X	6-8"	1"	60-70	pick every 3-7 days. Provide support with poles
Beets	X	X		X	2-4"	1/2"	50-65	beets will produce 4-5 plants per seed. Thin when young and cook tops as greens
Broccoli		X	X		15-18"	1/4"	80-100	Transplant into bed up to first true leaves. Harvest main head when buds begin to loosen. Side heads will form after bt head is cut
Brussel Sprouts		X	X		18"	1/4"	100-110	Harvest sprouts when they are 1 1/2" wide. Begin picking lower ones first.
Cabbage		X	X		18"	1/4"	80-100	Harvest when head is firm.
Carrots	X	X		X	2"	1/4"	50-75	Thin when plants are small. Harvest any size
Cauliflower		X	X		15-18"	1/4"	60-80	Tie outer leaves around head to protect from sun.
Celery	X		X		6"	1/4"	90-120	Requires a lot of water and nutrients
Chard	X	X		X	8"	1"	45-55	Cut leaves close to ground when 8-10" high. Harvest outer leaves first
Corn	X			X	12-15"	1"	90-110	Plant in blocks. Harvest when kernels are milky
Cucumber	X			X	12-24"	1"	60	Mound soil into hills. Plant three seeds in each hill
Eggplant	X		X		18"	1/2"	90	Grows well in hot weather
Garlic		X		X	4-6"	1/2"	180-200	Harvest with digging fork when tips start to die back

Vegetable	Warm Weather	Cool Weather	Sow In Flat	Sow Direct	Distance Between Plants	Depth to Plant Seeds	Days Until First Harvest	Remarks
Kale		x	x		15"	1/2"	100-120	Cut outer leaves close to stem when 10" or longer
Kohlrabi		x	x		8"	1/4"	50-70	Harvest when enlarged stem is 3" in diameter
Leeks		x	x		4-6"	1/2"	130-160	Plant out when 4" high
Lettuce		x	x		10-12"	1/4"	60-80	will go to seed in high temperature
Onion		x	x		4"	1/4"	85-200	Harvest with digging fork when tips start to die back
Parsley	x	x	x	x	4"	1/4"	70-90	Cut outer leaves near stem
Peas		x		x	4"	1"	60-80	Harvest Frequently
Peppers	x		x		10-12"	1/2"	80-100	Green peppers turn red when ripe
Potatoes	x			x	10-12"	6"	140-160	Dig up with digging fork after tops have flowered
Pumpkins	x			x	36"	1"	110-130	Mound up soil into hills Plant three seeds in each hill
Radish	x	x		x	1"	1/4"	25-40	Will get woody when over-mature
Spinach		x		x	4"	1/4"	50-55	Will go to seed in hot weather
Summer Squash	x			x	15-24"	1"	50-60	Harvest frequently
Winter Squash	x			x	24-36"	1"	80-120	Can store through winter
Tomatoes	x		x		18-24"	1/4-1/2"	80-100	Taste the difference!

A COMPANION PLANTING GUIDE

Vegetable	Plant With	Don't Plant With
Beans	Potatoes, carrots, cucumbers, cauliflower, cabbage, summer savory, most other vegetables and herbs	Onion, garlic, gladiolus
Pole Beans	Corn, summer savory	Onions, beets, kohlrabi, sunflower
Bush Beans	Potatoes, cucumbers, corn, strawberries, celery, summer savory	Onions
Beets	Onions, kohlrabi	Pole beans
Cabbage Family (cabbage, cauliflower, kale, kohlrabi, broccoli)	Aromatic plants, potatoes, celery, dill, camomile, sage, peppermint, rosemary, beets, onions	Strawberries, tomatoes, pole beans
Carrots	Peas, leaf lettuce, chives, onions, leek, rosemary, sage, tomatoes	Dill
Celery	Leek, tomatoes, bush beans, cauliflower, cabbage	
Corn	Potatoes, peas, beans, cucumbers pumpkin, squash	
Cucumbers	Beans, corn, peas, radishes, sunflowers	Potatoes, aromatic herbs
Tomatoes	Chives, onion, parsley, asparagus, marigold, nasturtiums, carrots	Kohlrabi, potato, fennel, cabbage
Peas	Carrots, turnips, radishes, cucumbers, corn, beans, most vegetables, herbs	Onions, garlic, gladiolus, potatoes
Squash	Nasturtium, corn	
Onion, garlic	Beets, strawberries, tomato, lettuce, summer savory, camomile	Peas, beans
Leek	Onions, celery, carrots	
Lettuce	Carrots and radishes (lettuce, carrots and radishes make a strong team grown together), strawberries, cucumbers	
Radish	Peas, nasturtium, lettuce, cucumbers	
Parsley	Tomato, asparagus	
Potato	Beans, corn, cabbage, horseradish (should be planted at corners of patch) marigold, eggplant (as a lure for Colorado potato beetle)	Pumpkin, squash, cucumber, sunflower, tomato, raspberry
Pumpkin	Corn	Potato
Spinach	Strawberries	
Sunflower	Cucumbers	Potato
Turnip	Peas	

Adapted from Organic Gardening and Farming, February 1972, p. 54.

HERBAL COMPANION PLANTING GUIDE

Herb	Companions and Effects
Basil	Companion to tomatoes; dislikes rue intensely. Improves growth and flavor. Repels flies and mosquitoes.
Beebalm	Companion to tomatoes; improves growth and flavor.
Borage	Companion to tomatoes, squash and strawberries; deters tomato worm; improves growth and flavor.
Caraway	Plant here and there; loosens soil.
Catnip	Plant in borders; deters flea beetle.
Camomile	Companion to cabbages and onions; improves growth and flavor.
Chives	Companion to carrots; improves growth and flavor.
Dill	Companion to cabbage; dislikes carrots; improves growth and health of cabbage.
Fennel	Plant away from garden. Most plants dislike it.
Garlic	Plant near roses and raspberries; deters Japanese beetle; improves growth and health.
Horseradish	Plant at corners of potato patch to deter potato bug.
Lamb's-Quarters	This edible weed should be allowed to grow in moderate amounts in the garden, especially in corn.
Lemon Balm	Sprinkle throughout garden.
Marigolds	The workhorse of the pest deterrents. Plant throughout garden especially with tomatoes; it discourages Mexican bean beetles, nematodes and other insects.
Mint	Companion to cabbage and tomatoes; improves health and flavor; deters white cabbage moth.
Marjoram	Here and there in garden; improves flavors.
Nasturtium	Companion to radishes, cabbage and curcurbits; plant under fruit trees. Deters aphids, squash bugs, striped pumpkin beetles. Improves growth and flavor.
Petunia	Protects beans.
Purslane	This edible weed makes good ground cover in the corn.
Pigweed	One of the best weeds for pumping nutrients from the subsoil, it is especially beneficial to potatoes, onions and corn. Keep weeds thinned.
Rosemary	Companion to cabbage, bean, carrots and sage; deters cabbage moth, bean beetles and carrot fly.
Rue	Keep it far away from Sweet Basil; plant near roses and raspberries; deters Japanese beetle.
Sage	Plant with rosemary, cabbage and carrots; keep away from cucumbers. Deters cabbage moth, carrot fly.
Summer Savory	Plant with beans and onions; improves growth and flavor. Deters bean beetles.
Tansy	Plant under fruit trees; companion to roses and raspberries. Deters flying insects, Japanese beetles, striped cucumber beetles, squash bugs, ants.
Tarragon	Good throughout the garden.
Thyme	Here and there in garden. It deters cabbage worm.
Yarrow	Plant along borders, paths; near aromatic herbs, enhances essential oil production.

Adapted from Organic Gardening and Farming, February 1972, pp. 32 & 33.

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Cultivating Support for the Growing Classroom

Kelly Simone age 10

Cultivating Support For The Growing Classroom

Any good gardener will tell you that in order to have a successful garden you need to build the soil, fertilize it well, and tend your plants with loving care. A school garden will require that plus more! Whether you're working with planter boxes, or an acre of land, in the middle of a large city, or surrounded by farmland, you're doing something unique in the educational system.

That uniqueness requires that in addition to cultivating your plants you must cultivate support from teachers, students, parents, and the school administration. Together you must work toward developing "site ownership", or shared sense of responsibility for your program. Before long you'll find word-of-mouth (as well as the scent of your narcissus and roses) attracting parents, community groups, and individuals who have not been involved with elementary school since they were students.

In this section we detail our efforts to develop a common site ownership by involving teachers, administration, and our community in continual support and enchancement of our program.

Site Ownership

It's difficult to recall the unused lot that stood adjacent to the school building just four years ago. Now it is covered with garden beds, fruit trees, a scarecrow, and active children. Two features were critical in building our program at Green Acres School: 1) we started small and developed our curriculum and site slowly; 2) teacher participation in our program is voluntary. Thus we began with a very manageable site requiring minimal commitments from teachers.

The gradual development of both site and curriculum involved active participation of both students and teachers. Thus students helped to create their learning setting, and teachers provided continual direction and feedback about our curriculum program. For more than four years we have all worked together--teachers, administrators, and students--to develop our three-acre site and a curriculum that integrates science and nutrition instruction with the garden.

The original Life Lab site was 30'x 30', and had the interest or involvement of only a third of our faculty. A parent volunteered to rototill the land, and tools were purchased at the Flea Market. The garden was originally conceived of as an extra-curricular project, and was used by a handful of teachers as often as they wanted--some three times a week, others once a week, some with small groups, others with the whole class.

Side by side, teachers and students learned the joy of planting a garden and watching it grow, of harvesting and eating from it. By the end of the school year 16 of 17 teachers in the school were participating in the program. Many discoveries took place that year: the discovery of nature, of watching a spider spin its web, of learning to like spinach when you never thought you could, of how to make the soil a good home for seeds. But one of our greatest discoveries was that the school garden was much more than just a garden. It was a powerful learning tool. The

garden provided a much-needed context in which children could apply academic concepts.

Thus our staff decided to develop our successful gardening program into a school-wide science and nutrition program, and wrote the Project Life Lab proposal to E.S.E.A. Title IV-C for funds. From this federal seed money, an integrated curriculum was created, and successfully field tested at other schools.

At one such school, a fourth grade teacher began the garden program with one large planter box. As soon as the planter box was outside the classroom, several other teachers requested to participate and have boxes outside their classrooms as well. Students enthusiastically dug in their planter boxes, measured plants as they grew, and happily harvested fresh vegetables. Before long most of the other faculty built planter boxes, using money provided by the PTA. Thus a "growing classroom" can be developed by one teacher, a few teachers, or the entire faculty, and unify the entire school on a "common ground".

Site Use

Whether indoors or outdoors, your garden will provide a learning site with a million and one uses. If your site is outdoors, there are many ways you might want to organize it. At Life Lab we schedule each class to come out to the garden site once a week.

The class is divided into three groups: one group has a science lesson, one a gardening lesson, and the third a nutrition lesson. Over a three week period the groups rotate through the science, nutrition and gardening centers to receive all three lessons. The lessons are all interrelated and allow nutrition and science concepts to be applied in a hands-on fashion.

The assistance of volunteers and aides has been integral to keeping the teaching groups small (please see volunteer section p. 52). While the classroom teacher conducts the science lesson, the teacher's aide could teach the nutrition lesson, while volunteers are involved in gardening instruction. Aides also help by setting up the materials for the next class.

Teachers supplement outdoor hands-on learning with indoor science lessons from the Growing Classroom. This classroom instruction provides important continuity with the outdoor activities. Teachers prepare for these lessons by meeting monthly to review the upcoming science and nutrition units. These meetings provide the staff with a basic introduction to the lessons, and also serve to develop their confidence in their ability to teach science.

Three other elementary schools have begun to use the Life Lab curriculum. Each school has adapted the curriculum in a different way, depending on their ability to staff the lessons and maintain a site.

Santa Cruz Gardens School has interspersed the lab site throughout their campus: the Science Center sits among a grove of pine

trees, while a flower garden, a vegetable garden, and the Nutrition Center are all in other locations. This school is able to use small-group instruction by coordinating volunteers to assist the classroom teacher. Regular inservices held for the volunteers have enabled them to follow the lesson plans easily.

The two other schools that have adopted our program (Salsipuedes School and Mountain School) have organized it differently. Instead of dividing the class up into three centers, each individual teacher teaches appropriate lessons to the whole class. Most of the science and nutrition curriculum is suited to a large class setting. With lessons that require small groups the teacher or aide works with the small group while the rest of the class does other classroom work. Teachers using this method have enjoyed the flexibility it gives them to use the Life Lab curriculum as their schedule permits.

Your outdoor classroom has many uses beyond the science curriculum. At Green Acres, teachers use the garden for a great variety of purposes, from art lessons to creative writing. One teacher has each student pick a special secret spot where they go to write in their journal. Another teacher has students learn about metric measurements by measuring plant growth in metric units. Two classes studying Ohlone Indian culture built a life-size replica of an Ohlone tule hut in the garden.

At lunch time we operate clubs created in response to student interest. Some of the popular clubs are: gardening, earthworms, art, storytelling, herbs, recycling, and snakes. Each club is usually coordinated by a volunteer and meets at least once a week.

The use of your garden site will grow and develop from a Science Center to a focal point for the creative interests of both teachers and students. Teachers will soon develop their own lessons to use at the site. A variety of activities can be implemented, learned from, shared and enjoyed.

There are two questions we are often asked relating to site use: 1) where does all the food go? and 2) what happens in the summer?

As each class is totally responsible for two garden beds -- digging, planting, weeding and watering them -- they of course harvest them. The food goes home with those students, or is eaten as part of our nutritious snack program. In addition, we have a number of garden beds where we grow vegetables to be used in the school cafeteria. We've had great success with serving our annual crop of corn to the children at lunch time. Further, we've provided the cafeteria with lettuce, carrots, and kohlrabi that has gone into fresh salads for the children. During the summer, some of the produce gets sold at our local Farmer's Market.

Each summer we run a fee-supported summer program. The sessions (we've successfully tried both three and four week) are held mornings only and limited to twenty children. We've run it as an environmental education program with emphasis on gardening, and included weekly field trips, art and crafts, environmental awareness activities, and food making.

These small individualized intensive sessions allow the children to develop a better understanding of their garden than they are able to gain during the school year. The beauty of a garden reaches its peak during the summer, and it is an ideal time to have children active in it.

Administration Support and Involvement

The introduction of a new program to a school is not easy. It is essential to involve your administrators in every level of the process, and to cultivate understanding by continual communication. Our administrators have been key in insuring the integration of the Life Lab program into the structure of the school and the district. The Green Acres principal was involved from the very beginning in the grant process, then in establishing the site and involving individual teachers in the program. Because of his vision of the value of a hands-on educational program, Life Lab was incorporated into the school in the best way possible to meet the educational needs at Green Acres.

> "The garden looks beautiful and it's nice that the kids get to learn how to plant and grow their own food, but how does it relate to academic learning?"
>
> "This is the highlight academic program of our school district."

These are both comments from school board members. Their difference in opinion is just one reason why it is so important to keep the district superintendent and school board members informed of the learning that is taking place at your garden site. It is easy to look at a garden and appreciate its beauty, but it is not easy to understand its connection to a place of academic learning. This can be accomplished by inviting your superintendent and school board members to visit the site during a lesson. They will observe first-hand that concept-building takes place at a rapid rate when students are active participants in their own education.

When new school board members were elected, we immediately invited them to visit Life Lab. Their visits gave them a full picture of what we, as teachers, were trying to accomplish. The support of our principal, the district superintendent, and the school board has led to the greater success of Life Lab. Their support has allowed Life Lab to become an integral part of the district curriculum.

As a teacher, it is worth your effort to involve your principal in the program. Further, we recommend that you update the superintendent and school board on your progress by inviting them to your site, and follow up with reports and presentations at school board meetings.

Community Connection

Community support is another important resource to tap. Recreational programs such as Little League or Girl Scouts depend upon the community for their support: they often go to local businesses for sponsorships and enlist volunteers to direct activities. Now that our schools are experiencing financial difficulty, we too, can turn to our communities. The high-quality educational programs eliminated from our schools today will affect our community tomorrow.

Seek the help of parents, interested individuals, organizations, and businesses. By involving them in your project, you will be promoting a greater sense of community as they join forces for their school. What this can mean for your school is added creativity, more volunteers, materials, and financial contributions. In return, your school can offer the community facilities, workshops, and an appropriate center for focussing community effort and creativity.

We started to involve the community in our program by our third year. By this time we were sewn into the school's fabric, with a well-developed curriculum and rapport with both teachers and administration. In our outreach efforts we have developed a volunteer program, solicited local businesses for donations, developed cooperative programs with other agencies, sponsored community events, and created our own support group. The following descriptions detail a step-by-step approach to such an outreach program.

Volunteers

Volunteers have become instrumental to our work at Project Life Lab. Their value has been great for the following reasons: 1) volunteers enhance the adult/student ratio in our program; 2) volunteers increase the diversity of adults our students have contact with; 3) volunteers serve as spokespeople for our school and program in the community; 4) volunteers add energy and offer expertise to our school.

We have tapped many sources in search of volunteers. The University of California at Santa Cruz has been very cooperative by offering credit for participating students from the Education and Environmental Studies departments. Cabrillo Community College has supported students through the Horticulture and Solar Technology programs. The Soquel High School Community Studies class and the Monday School, an alternative high school program, have placed students with us. Parents and other community volunteers seeking to work with children in a garden environment have been very helpful.

Finding volunteers requires some effort, but there are usually a great variety of ways to solicit them.

(1) Send home a volunteer request letter to parents.

(2) Put a notice in your school (and district) newsletter to parents.

(3) Call the local newspaper education writer and let him or her know of your program and its need for volunteers. If you're lucky, it may warrant an article.

(4) Send a short public service announcement on a 3" x 5" card to the local radio station.

(5) Contact the local college and university.

(6) Have your students prepare advertising posters for volunteers.

(7) Recruit at the local senior center.

Once they arrive, your volunteers should have a formal work schedule and clearly defined tasks.

Volunteers will come to you with varying degrees of experience with children and/or gardening. We orient volunteers with a short workshop in basic gardening including double-digging, sowing seeds, flat preparation, transplanting, and watering techniques. We review upcoming lessons with them in regular group meetings. They observe teachers instructing different lessons until they feel comfortable teaching a small group on their own. The number of students per volunteer rarely exceeds ten, and has most often been five or less.

Evaluate their lessons with them, and develop a structure for them to use for disciplining students. Acknowledge their work and let them know how valuable their work is to you and to your students. Give them feedback about their work. The more they feel part of the project, the more you will be able to depend upon them.

This can take much effort, but once the groundwork is laid, you will be rewarded with a steady flow of energetic individuals. All of our volunteers at Project Life Lab now come to us by word-of-mouth. You will find that a great variety of people will want to be a part of your unique and innovative program.

Donations

The first donation to Life Lab was materials to build the solar greenhouse. It came from a local building contractor. Since then donations have varied from wheelbarrows to discarded plants from nurseries to architectural drawings for our barn. The many donations we have received have allowed us to expand our program well beyond our own financial means.

These are the steps that we follow when pursuing donations:

(1) Develop a specific project. (Example: solar crop drier.)

(2) Make a materials list of exactly what is needed.

(3) Make a list of businesses who could potentially supply these materials.

(4) Make an appointment to go in person to talk to the owner or manager.

In the meeting we describe our program and the new project. We show the business person the materials list and ask them to donate a few things on that list. Once you have commitments to the project, show prospective contributors a list of past donors. In that way they feel they are joining together with other businesses to support a project. It always is a lot easier after you have your first donor! Each donation, no matter how small, should be followed with a thank-you letter. Keep a file of who has given what and when.

If you are raising funds or materials for a large project, you may want to develop a promotion packet. We put together a packet when pursuing donations for our livestock barn. The packet described our program, detailed the plans and use of the proposed barn, listed all of our needs from lumber to electric supplies to labor, and listed donors as we got them. In the description of the program we were sure to include newspaper articles and other evidence of past success. We now have a completed barn that reflects the efforts of over 70 businesses and individuals!

Parents are another possible source of needed materials. Keep them informed of what is going on at your garden site. (You'll be surprised at how much they already know from their children!) Send home letters with lists of things you might need. We have received tools and a refrigerator this way. Further, the parents may work for businesses that would be interested in supporting your program.

Establish on-going contact with businesses that are garden related. For example, we have asked local nurseries to call us when they are discarding plants or flats. Landscape suppliers could help out with plants and expertise; hardware stores with tools, or irrigation supplies; stables with manure and straw.

Asking for donations will produce a ripple of benefits. Aside from directly enriching your program, it informs the community about what is happening at your school, and demonstrates the important role they can play in improving education. Once you develop a donation request format, involve parents and volunteers in the solicitations. Take advantage of the diversity in your community; it will enrich your school.

Interagency Relationships

It has been a great pleasure for us to work out mutually beneficial relationships with many community agencies. Some of these are:

1. Community College and Local University. As we give work experience in the areas of horticulture, solar technology, and education to students, they in turn add their creativity and energy to our program. We recruit students by making announcements in their classes. Credit is arranged by the student and instructor, and we provide the training. Many take on their own special projects, which become part of the Life Lab site.

2. High Schools. They often have student employment programs with funds to pay students to work a certain number of hours per week. These students have helped us maintain the garden site, set up materials for classes, and work with children in the garden.

3. Youth/Senior Employment. Presently there are federally-funded programs that find and pay for employment of disadvantaged youth and seniors. While providing job training for the young and viable employment for the elderly, these programs have allowed us to upgrade the quality of our operations. To find out if such programs exist in your area, contact your county social services agency.

4. 4-H. We live in an area where most children cannot raise animals in their backyards and many children have never been exposed to small livestock such as sheep and goats. To give this experience to our students and to incorporate animals into our science program, we have developed a livestock program with the county 4-H, which will coordinate livestock projects at the school. Students who choose to participate will house the animals in our barn and will be responsible for care and feed. The school will be able to regularly use the animals to teach the rest of the students. Thus 4-H is able to expand their program to city areas and we are able to have animals as part of our program, with the necessary expertise and at no cost to the school.

5. Community Gardens. The Community Gardens in our county sets up garden plots on donated land and rents them at low cost to people who do not have garden space at their homes. In inviting the Community Gardens to establish such a site at our school, we asked that plots be given preferentially to seniors. Our plan is to ask community gardeners to spend some time with our outdoor classroom program, in order to develop intergenerational relationships with our students. We will also share certain site features with them, such as our herb circle and compost area.

6. Gardening Clubs. Local gardening clubs will often print an article about you in their newsletters. They can also be a good source of volunteers and donations.

We make sure to have formal written agreements between our school board and agencies that establish their own program on our site, such as 4-H and Community Gardens.

There are numerous agencies and programs to reach out to in any community; we have listed only a few. Your ability to establish agreements with them will, of course, depend on your time and energy. For us it has been well worth the effort!

Make Your Own "Friends"

In our second year we formed a support group called "Friends of the Harvest." We had generated enough community interest to involve educators, business people, school parents, farmers, and community residents as paying members. The support group established a Board of Directors, which formed its own by-laws and has received non-profit tax status separate from the school. This allows the Board to apply for its own grants if so desired.

Each year the Board pursues one major project. In its first year, Friends of the Harvest successfully raised all the funds and materials needed to build our livestock barn. Now, in its second year, the group is working to raise general funds to maintain the Life Lab program. Thus, Friends of the Harvest members have become our community advocates in approaching local businesses and others for financial donations. Their role comes full circle, too, because they supply the program with a full community perspective and help us use the school to meet community needs. Thus, they form an important two-way liaison between the school and the community.

It is feasible to look within your existing organizations for your support groups. Groups like PTA and School Site Councils can easily be advocates for your program.

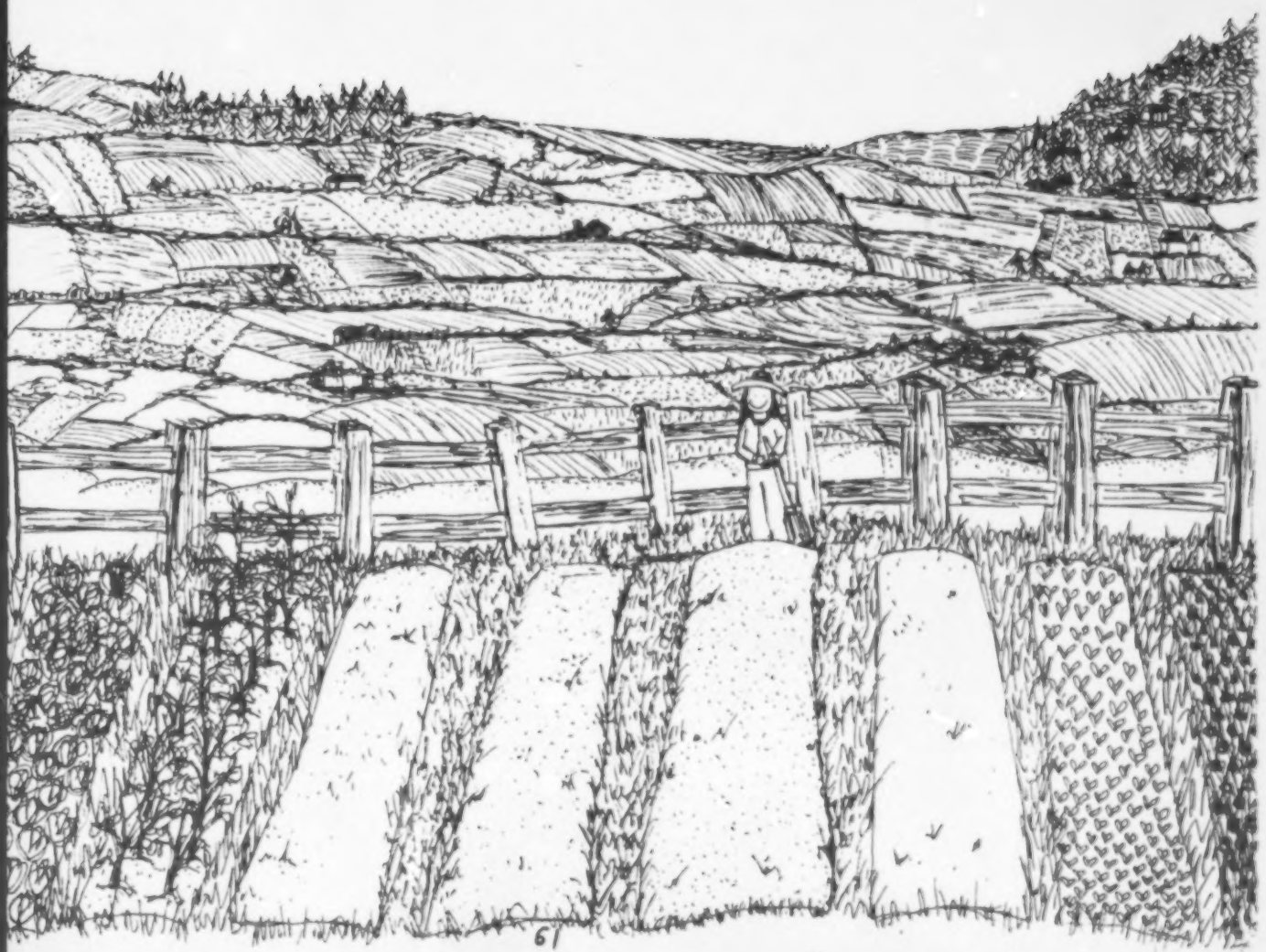
Events

Events that take place at Life Lab serve four purposes: (1) to give the community an opportunity to find out about our program; (2) to serve as a fundraising event; (3) to give us an opportunity to thank the community for their participation and support of our program; (4) to provide a community service.

Thus far we have developed three annual events. In the fall we have held a brunch (the first year) and a barbeque (the second year) honoring individuals and businesses who have made outstanding contributions to our program. In the springtime we kick up our heels with a fundraising square dance. In addition, at the end of each school year we have an Open House where each class displays a science project that they have developed. The fall event and the square dance are both sponsored by Friends of the Harvest. They also sponsor Saturday workshops for the community on different gardening topics.

Thus our site has become available in a great variety of ways for people who do not normally associate with the schools. Their participation allows them to see the significant role of schools in their community. Your project can become a vehicle for community expression of interest in our most important resource--our children.

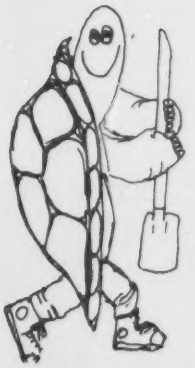
BASIC GARDENING



These lessons make it easy to garden with children by detailing a step-by-step approach to the fundamentals of gardening. Students will leatn to handle tools, dig garden beds, sow seeds, transplant, and make compost.

Lesson Titles	Recommended Grade Level
The Tool And Me	All
Dig Me And Dig Me Again	All
So What? Sow Seeds!	All
Transplanting, Or Let's Move'Em Out!	All
Let's Make A Compost Cake	All

The Tool and Me



purpose

To instruct proper tool use and care.

This activity uses role playing to demonstrate safe tool use.

Discuss history and importance of tools. Prehistoric humans developed simple tools to aid in hunting. Some animals are thought to use tools. One species of monkey dips a piece of grass in termite and ant nests, eating those ants and termites that attach themselves to this handy tool. Sea otters use a rock or other hard object to crack shellfish for their tasty meals. Ask the students to list examples of tool use by people or animals. Would we be able to garden easily without tools?

Show students tool storage area. Go over names of tools. Demonstrate proper storage. Have each student take a tool so that at least one of every tool is represented.

Use role playing to teach the following safety rules for tool use and care.

*Spading forks and shovels should only be used by those with shoes on (No sandals).

*Walk with tools.

*Keep tool below shoulder level.

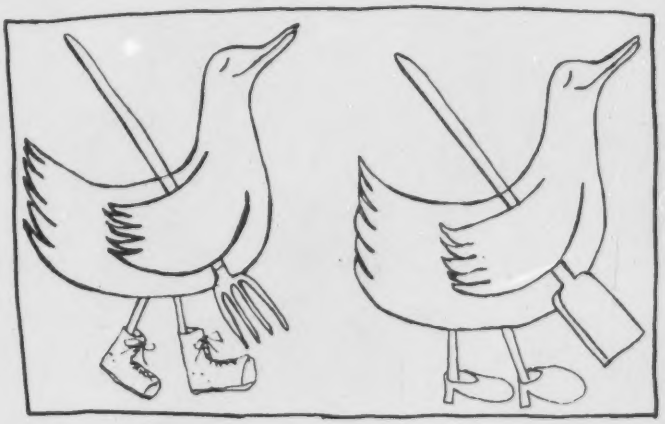
*Take your time. Wait until the person is out of the way.

*Do not use tool in crowded area.

*Always clean tool before you put it away.

*Never leave tool on the ground. Stand it up or return it to the storage area.

*Always walk with the wheelbarrow. Do not use it for rides.



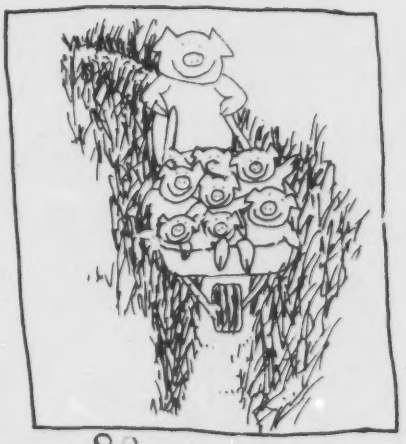
To use role playing:

*Decide on an improper tool use. (i.e. running with a rake)

*Ask for a volunteer student.

*Whisper the action to the student.

*Have the student role play the action.



*Ask the group to identify the improper use.

*Repeat with a different action or series of actions.

After role playing, demonstrate tool cleaning. Scrape tool with a rough brush. Make sure all dirt is removed. Then dip in a container of sand which has been soaked with used motor oil. Once the tool use and care has been covered, you can begin basic gardening activities.

Why did people develop tools? What are some examples of tools no longer used? Give examples of improper tool use that could result in injury.

As the group works in the garden, any student can call "freeze" if they observe an unsafe or inappropriate tool use. It can then be discussed.

Dig Me and Dig Me Again

purpose

To demonstrate proper soil preparation for plants.

Materials: shovels, spades, digging forks

We begin preparing the garden site by demonstrating to students the "double-digging" method of soil preparation.

The goal of double-digging is to loosen the soil to a depth of 24 inches. We loosen the soil to allow the roots to grow easily and to let air and water into the soil. Discuss with students why this is important.

We will plant our crops in 'beds'. (Look at the bed you're standing around.) The beds are for the plants. The people-paths around the beds are for us.

There are many different methods used to prepare a garden plot. Our two steps will be: (1) loosening the soil; (2) adding nutrients to the soil.

Double-digging:

*Dig out a trench across the width of one end of a bed about 1 foot deep and 1 foot wide. Pile this soil at the end of the bed. (Not on the bed; this soil will be used to fill in the last trench.)

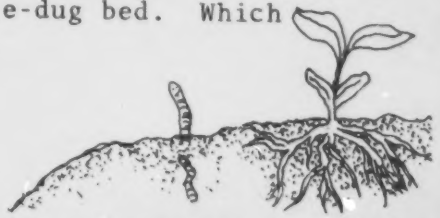
*Standing on the untrenched part of the bed, try to dig the digging fork into the trench another 12 inches. Put the fork down as far as it will go, and "wiggle" it--trying to loosen the subsoil, but not remove it. Do this across the entire trench.

*Dig another trench behind the first one. This time use this soil to fill the first trench. Remember the trenches should only be 1 foot wide. Then loosen the subsoil. Continue along the bed until it is completed.

*When you have emptied the very last trench and loosened the subsoil, fill that trench with the soil you laid aside from the first trench.

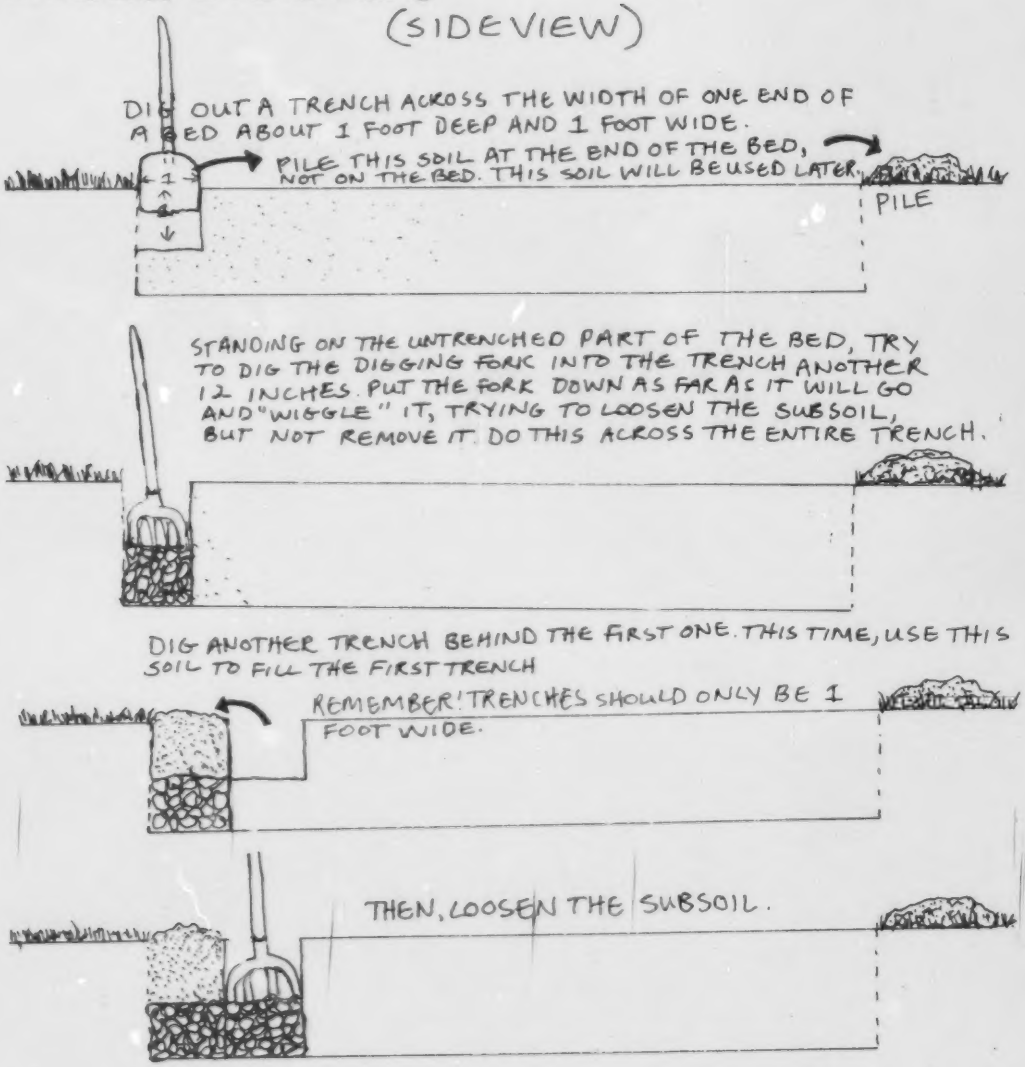
Now the students are ready to dig beds. As soon as they understand the double-digging procedure, divide the pairs as follows: Have one pair start at an end of each bed and work toward each other. If the bed is long enough, two can also start in the middle. Dig on!

Imagine you are a little seedling trying to grow your roots in a hard, compacted pathway. Think of your fingers as roots. Would it be easy to poke them through the soil? Now imagine you are growing in a double-dug bed. Which place do your roots prefer? Why?



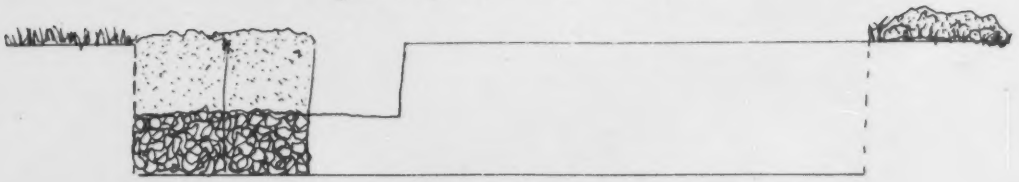
DOUBLE DIGGING

(SIDEVIEW)

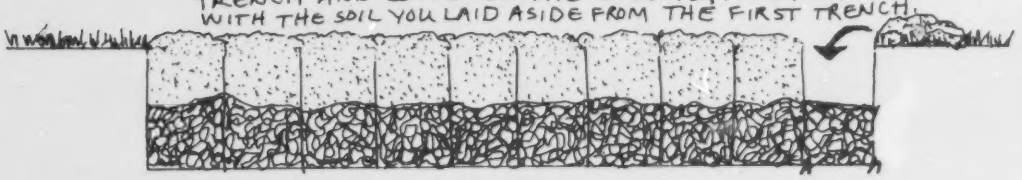

DIG OUT A TRENCH ACROSS THE WIDTH OF ONE END OF A BED ABOUT 1 FOOT DEEP AND 1 FOOT WIDE.
1
PILE THIS SOIL AT THE END OF THE BED, NOT ON THE BED. THIS SOIL WILL BE USED LATER.
PILE
STANDING ON THE UNTRENCHED PART OF THE BED, TRY TO DIG THE DIGGING FORK INTO THE TRENCH ANOTHER 12 INCHES. PUT THE FORK DOWN AS FAR AS IT WILL GO AND "WIGGLE" IT, TRYING TO LOOSEN THE SUBSOIL, BUT NOT REMOVE IT. DO THIS ACROSS THE ENTIRE TRENCH.
DIG ANOTHER TRENCH BEHIND THE FIRST ONE. THIS TIME, USE THIS SOIL TO FILL THE FIRST TRENCH
REMEMBER! TRENCHES SHOULD ONLY BE 1 FOOT WIDE.
THEN, LOOSEN THE SUBSOIL.

MORE

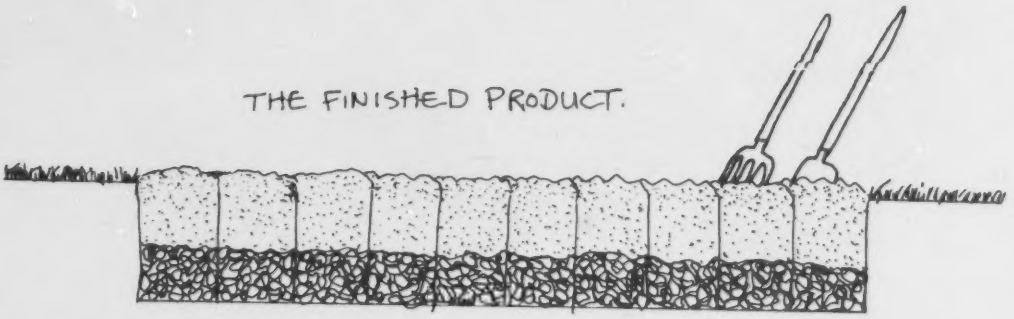
CONTINUE ALONG THE BED.....



UNTIL IT IS COMPLETED.
WHEN YOU HAVE EMPTIED THE VERY LAST TRENCH AND LOOSENED THE SUBSOIL, FILL THAT TRENCH WITH THE SOIL YOU LAID ASIDE FROM THE FIRST TRENCH.



THE FINISHED PRODUCT.



So What? Sow Seeds!

purpose

To demonstrate proper flat soil mixing and seed sowing.

Materials: Flats, seeds, water, shovels, masking tape, marking pen, and flat mix.

Students can help baby seeds grow by learning how to properly prepare a flat mix and sow a greenhouse flat.

Prior to making the flat mix, read and discuss the following with students:

The compost in the flat mix is a nutrient source, providing nitrogen, phosphorus, potassium, and other nutrients for the growing seedlings. Adding topsoil helps the seedlings adapt to the soil life (including bacteria and fungi) that they will eventually live with once transplanted. Sand provides for better drainage, preventing the seedlings from rotting.

*Make the flat mix.

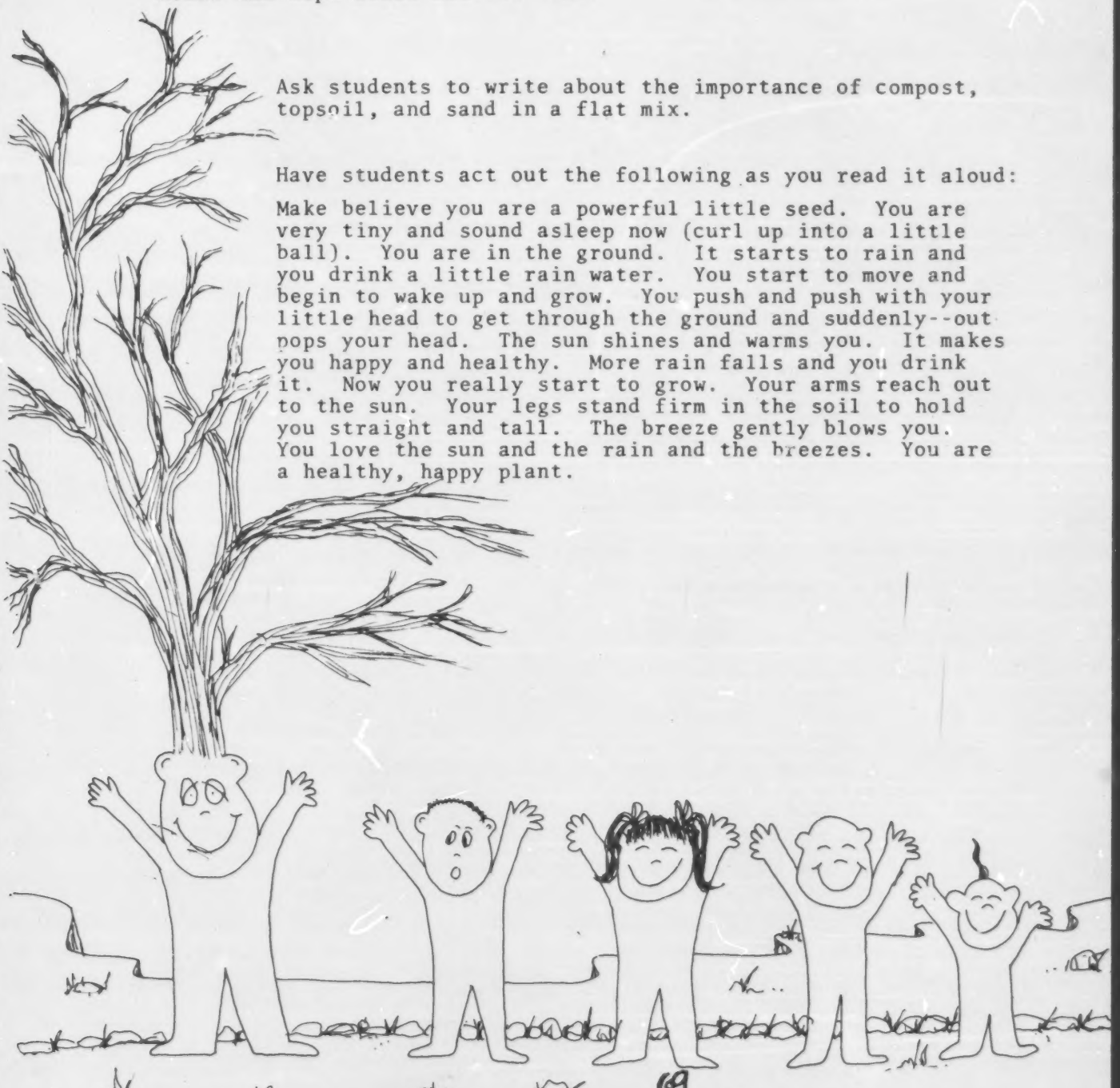
*Divide the group into two teams and give each team one flat to fill completely to the top. Gently run your hands or a board over the flat surface so that the mix is flush with the top of the flat.

*Now you are ready to sow seeds. Run your finger side to side in the flat to make a series of parallel shallow grooves as close together as possible. But not too shallow! The rule of thumb is that seeds should be planted to a depth roughly 3-5 times their smallest diameter. The bigger the seed, the deeper it goes. But not too deep! Better to undercover than vice-versa.

FLAT MIX RECIPE
THE MIX SHOULD IDEALLY BE COMPOSED OF 1/3 COMPOST, 1/3 TOPSOIL, AND 1/3 COARSE SAND, MEASURED BY WEIGHT.
TO FILL TWO FLATS, TAKE.....
MORE
8 SHOVELFULS TOPSOIL (WHICH SERVES AS FILLER)
3 SHOVELFULS SAND (WHICH MAKES FOR BETTER DRAINAGE)
AND 10 SHOVELFULS COMPOST (WHICH PROVIDES NUTRIENTS)
MIX THOROUGHLY.
SPRINKLE WITH WATER WHILE MIXING TO MAKE THE PRODUCT MOIST BUT NOT SOPPING.
MORE

*Place the seeds in the grooves evenly spaced, about 1 inch apart. When the flat is sown, cover the seeds with flat mix or compost, and water thoroughly with a fine mist.

*Write the name and variety of the seed you have sown on masking tape and place on the side of the flat. You can also use wooden markers to put in the flats. Flats should be placed in a greenhouse and kept moist all the time.



Ask students to write about the importance of compost, topsoil, and sand in a flat mix.

Have students act out the following as you read it aloud:

Make believe you are a powerful little seed. You are very tiny and sound asleep now (curl up into a little ball). You are in the ground. It starts to rain and you drink a little rain water. You start to move and begin to wake up and grow. You push and push with your little head to get through the ground and suddenly--out pops your head. The sun shines and warms you. It makes you happy and healthy. More rain falls and you drink it. Now you really start to grow. Your arms reach out to the sun. Your legs stand firm in the soil to hold you straight and tall. The breeze gently blows you. You love the sun and the rain and the breezes. You are a healthy, happy plant.

Transplanting....or Let's Move 'Em Out!

purpose

To learn how to transplant seedlings.

Materials Seedlings in a flat that are ready for transplanting; hand trowels.

Seedlings need to be transplanted when they are overcrowded in the flat, and/or have their first true leaves. (Note: the first leaves to emerge are called cotyledons. They are not the true leaves.) Seedlings can be transplated either into another flat or directly into the ground. Transplant into another flat if it is too cold or wet to put plants into the ground, or if you want to pamper the plants a little longer. Make sure they are at least 2" apart in their new flat. Fill the flat with a flat soil mix (see p.68) to which you have added additional compost and a little bone meal.

If you plan to plant the seedlings into the ground, prepare the bed first (see Bed Preparation, p.15). Space plants in the bed far enough apart so that their leaves will barely touch when they are full grown (see Planting Chart -- p.56). Remind the children that when planting out, it is especially important to be gentle with the baby plants.

Allow the seedlings in one flat to overgrow, and observe the effects of overcrowding on them. For a lesson on the effects of overcrowding, see p.157.

Let's Make a Compost Cake!

purpose

To learn to make compost.

Materials: shovels and digging forks; compost materials (see p. 18 for details); hose (with fan sprayer on the end) and water.

*Note: Composting is covered comprehensively on p. 17 - 21. It provides important background for this lesson.

*Pick an area for your compost pile. (Remember: the further it is from your garden, the further you'll have to haul it!)

*Equip 4-8 children with forks and/or shovels, and assign one to be waterer.

*Using their spading forks, have children loosen the ground where your pile will be (at least 3' x 3' in area).

*Begin layering (lightly watering each layer):
(1) Stalky material first (for drainage).
(2) Straw or dried plant matter (a carbon layer).
(3) Manure, weeds or kitchen scraps (a nitrogen layer).
(4) Compost or old compost (bacterial activators).
(5) Repeat layers.
(6) Water each layer.

Experimental Beds

Lesson Titles	Recommended Grade Level
Introduction - Experimental Beds	5 - 6
What Good Is Compost?	5 - 6
What's In A Name?	5 - 6
To Dig Or Not To Dig	5 - 6
Star Food	5 - 6
Companion Planting	5 - 6

Experimental Bed Section

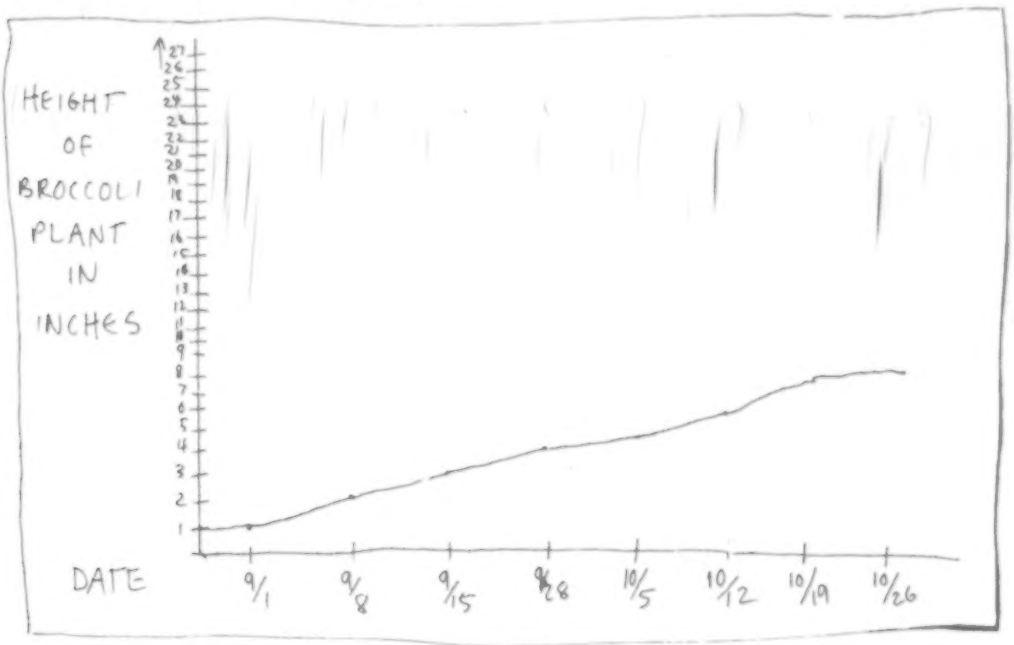
Introduction

The following five lessons are experiments for children to carry out in the garden. An experiment is a test or trial designed to illustrate something. The garden can be used as an outdoor laboratory to introduce students to the scientific method of proposing and testing out hypotheses by devising experiments.

In this section we explore ways to use our garden beds for experimental research. Because these experiments involve making observations over time (up to four months) it is advisable to have several experiments going at once. That way you can do several during the course of the school year.

It is instrumental to have information recorded. The class as a whole should make all observations and take measurements to record in their journals. You could pick an official "class recorder" to write or chart the information weekly on a special Garden Bulletin Board.

Information can be recorded in many forms. For instance, if you were measuring the growth of a broccoli plant, a chart like this might be appropriate:

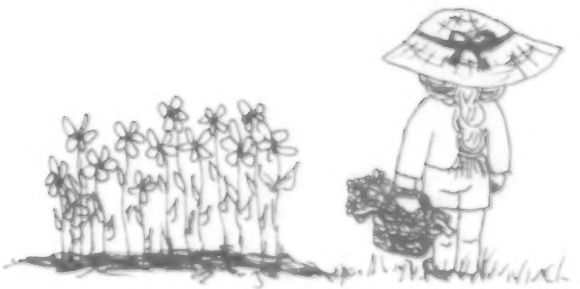


Experiments help introduce children to the idea of a scientific "control". Each time we start an experimental bed we also start a "control" bed. We try to treat each bed exactly the same (similar watering, fertilizing, thinning, etc.) and have only one variable (e.g. one bed has compost, the other has none.) That way we can see if that variable (e.g. compost) makes a difference in plant growth.

The idea of a control is basic to scientific research. Try to get the idea of a control bed to come from the kids (you could ask: how will we be able to tell if compost helps a plant grow?)

Here are some of our ideas for test plots. But the possibilities are infinite! Encourage the kids to come up with some of their own ideas, and ask them how they would devise a control for that experiment.

Good Luck!



What good is compost? ..... or, What hath rot wrought?

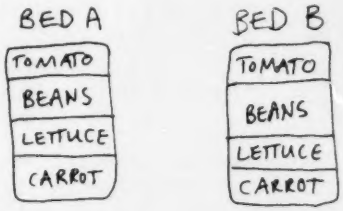
purpose

To determine the effects of compost on plant growth.

Materials: garden bed or planter box, seeds or seedlings

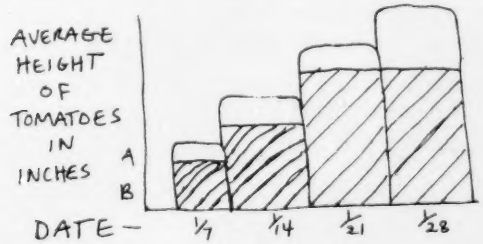
Plants have to eat too! They need a good balanced diet, just like people. Compost provides a healthy combination of important nutrients, like nitrogen, potassium, and phosphorus. Let's see if compost helps plants grow.

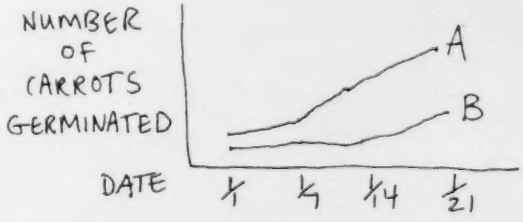
*Divide the bed (or box) in half and mark it off with string. Fertilize one half with ample amounts of compost, and the other half not at all. Plant the whole bed with one crop. Another possibility is to dig two beds, preparing only one with compost, and planting several kinds of the same types of crops in each bed:



It doesn't matter which crops you choose, but try to pick at least one root crop, one leaf crop, and one fruit crop.

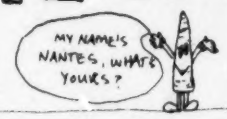
*Make charts comparing the success of each crop in the two beds. You could compare their germination, speed of growth, health as they grow, and their final size and taste when they are harvested!





Summarize your information at the end of the experiment. Which bed did better? If it was the one with the compost, why did it do better? Do people also grow better with better nutrition? Do they grow bigger, faster, and have fewer "pest" problems?

What's in a Name?



purpose

To discover that there are many varieties of each vegetable.

Materials: A dug and fertilized garden bed, and different varieties of one particular vegetable (For example, carrots come in many varieties like "long", "half-long", "coreless" etc.)

Read the following to your class as an introduction:

Picture a parsley plant. More than one image should come to mind, because there are all different types of parsley plants! Some have curly leaves and some don't; some have thick edible roots and some have long skinny ones. These different types are called varieties. Just as you and your brother or sister have the same parents and the same last name, so there are different varieties of each vegetable: they are very closely related, but still different!

Varieties are bred by plant scientists working for seed companies, and are developed for different characteristics. Some tomatoes, for example, make a big fruit; some resist pests and diseases better; some do well in certain climates and poorly in others. Some grow longer, shorter, rounder, redder, bigger, faster--on and on!

Let's find out if certain vegetable varieties are better for our climate and soil than others.

*Divide a garden bed (or planter box) into several equal sections and mark them off. Sow (or transplant) each section with one variety of one particular vegetable. Cover and water in.

*Try to treat all the varieties exactly the same: Thin at the same time (if necessary), water the same amount, etc.

*Make weekly observations and record all information on charts:

CARROTS: "NANTES" = A
"HALF LONG" = B
"CORELESS" = C
"LONG" = D

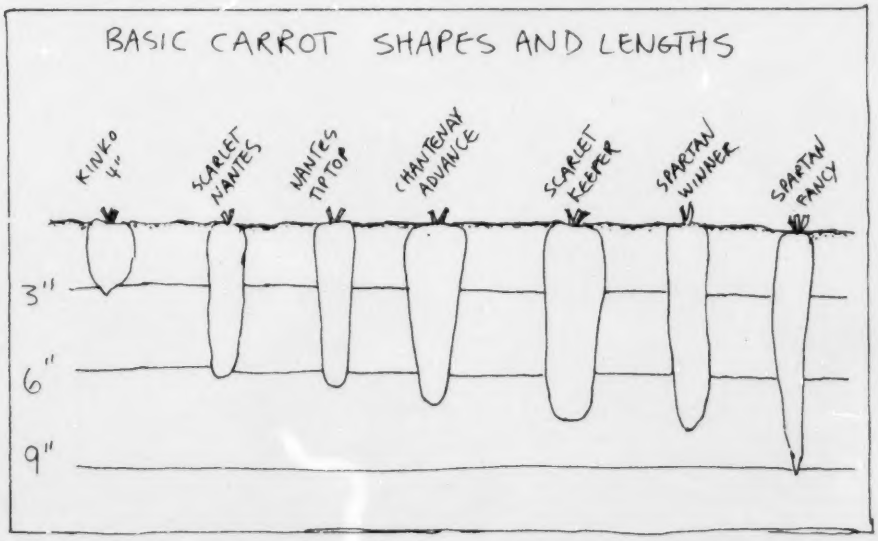
# GERMINATED				PEST DAMAGE (SCALE 0-5)				ROOT LENGTH IN INCHES				TASTE (SCALE 0-5)			
A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D

78

*When the crop is harvested and all the information is on the chart, have the class discuss the success of each variety. Which produced the most? Which grew the longest? Which tasted the best? Which factor is the most important? Is it better to have short sweet carrots or long bland ones? Which would you rather grow if you were a farmer?

*Ask the class to vote on the best variety. Would this variety necessarily be the best to grow no matter where you live? Why might another variety do better somewhere else? (different climate, different soil, shorter/longer growing season).

Have one student in the class call your local Agricultural Extension Agent and ask them to send you a list of recommended vegetable varieties for your area. (Did they pick the same vegetable variety that your class did?)



To Dig or Not to Dig; That is the Question

purpose

To discover the effect of compaction on plant growth.

Materials: Seeds or seedlings, a garden bed that has been double-dug but not fertilized, and a compacted area (like a path) nearby.

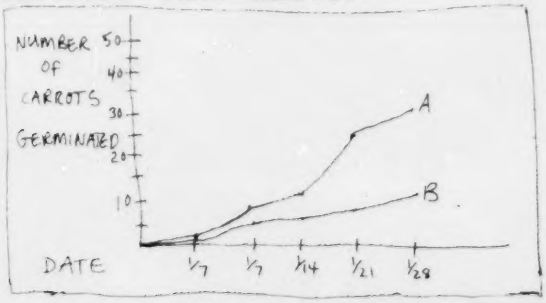
The following can be read to students as background:

We double-dig in order to make the soil less compacted. Compacted means dense, or packed closely together. When soil is compacted, there is less room for air, water doesn't drain out (so roots rot), and seedlings have a hard time pushing through the soil.

Discuss with students the causes of compaction (people walking, cows grazing, machinery, etc.). Remind them that we avoid walking on our garden beds to prevent compacting them.

*Plant the double-dug bed (Bed A) and the compacted area (Bed B) with the same amounts of the same kinds of seeds (or seedlings). Try to keep all other factors the same: the soil should be similar (one shouldn't have much more nutrients); watering should be the same, etc. They should both be planted the same, thinned if necessary. In short, both planted areas should be given exactly the same care.

*Make weekly notes on the progress of the plants: which germinate faster, grow faster, get bigger, look healthier, have less insect or disease damage? Did more plants survive in one place than another? Make charts:



LENGTH OF GROWN CARROT
—IN INCHES—

BED A	BED B
6	3
8	2
4	4
7	4
7	3
6	5
AVERAGE 6 1/3"	3 1/2"

When the crops mature, review your charts on each vegetable. Which bed did better? Most likely the double-dug bed will produce the healthiest plants. Review the reasons why it is important to loosen the soil.

Ask students to stick out their finger and pretend it has become a seed. Have them try to push their seed-finger into a compacted area. They should really push around and feel how hard it is. Now ask them to sink their seed-finger into a double-dug bed. Finally ask them to "plant" their finger-seed where they think it would grow the best.

STAR FOOD

purpose

To discover if we can increase photosynthesis by reflecting more light onto a plant.

Materials: Two garden beds (or one long one); plants to transplant (larger plants, like broccoli and tomatoes, are preferable), aluminum foil (ask kids to recycle some from home).

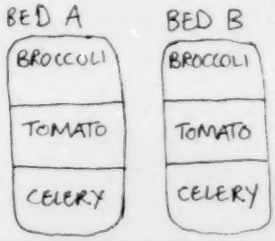
Read the following to students as introduction:

Plants are able to make their own food using energy from the sun, by a process called photosynthesis. The more the sun shines on a plant, the more energy the plant has to produce the carbohydrates which keep it alive.

Will plants grow better if we artificially supply them with more sunlight? We can do this by putting a reflective surface (like aluminum foil) on the bed surface under the plants. This will cause a lot more sunlight to be reflected onto the plants.

*Dig and fertilize each bed exactly alike.

*Plant out each bed with the same amount of different crops. They could look like this:



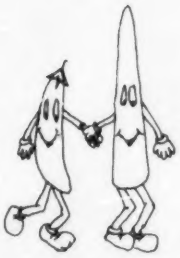
*Place a wide "collar" of aluminum foil around the base of each plant in one bed, and leave the other bed alone. Try to have as much of the bed covered with foil as possible. If necessary, weigh down the foil with rocks. Try to treat each bed exactly the same, and remember to remove the collar when you water!

*Every week, observe and take measurements of the plants as they grow. To compare growth, you could use charts like the one in the introduction to the "Experimental Bed" section, p.75.

Did the plants of one bed grow faster? or bigger? If so, why?

It is said that flying insects get confused by the reflection of the sky in the aluminum foil, and will avoid the plants in the reflecting bed. Do you find that fewer insects visit the plants in the foil bed? Do those plants have less insect damage?

Companion Planting



purpose

To determine if plants influence one another's growth.

Materials: garden bed(s), seeds or seedlings

Read the following to students as introduction:

Do you think plants influence one another? Some possible ways that plants could affect each other are:

--one plant might repel a "bad" insect away from another plant if they are side-by-side (a "bad" insect is one that damages the plants in your garden).
--conversely, one plant may attract an insect that helps or hurts another plant.
--roots of a plant may exude (give off) chemicals that "bad" insects don't like.
--physical effects: one plant may shade another, protect it from wind, etc.

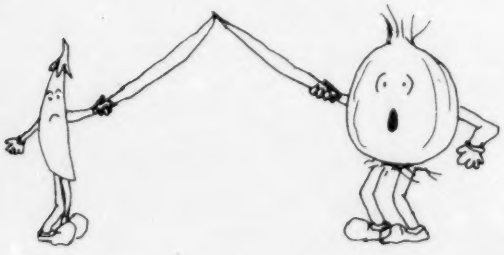
*Elicit suggestions from the students about other ways that plants could affect each other. Let them be imaginative--it doesn't have to be realistic--the concept is what is important.

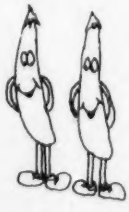
*Prepare three beds (or divide one bed into three equal parts) in exactly the same way.

*Choose a plant you want to test and refer to "A Companion Planting Guide," p. 36 for one plant it "likes" and one it "dislikes".

*Plant Bed A with your selected plant and its "friend"; Bed B with your plant and its "enemy"; and Bed C with the plant by itself. Bed C will serve as our control.

For example, if you picked beans to test, Bed A could be beans and carrots (a friend); Bed B beans and onions (an enemy); and Bed C just beans.



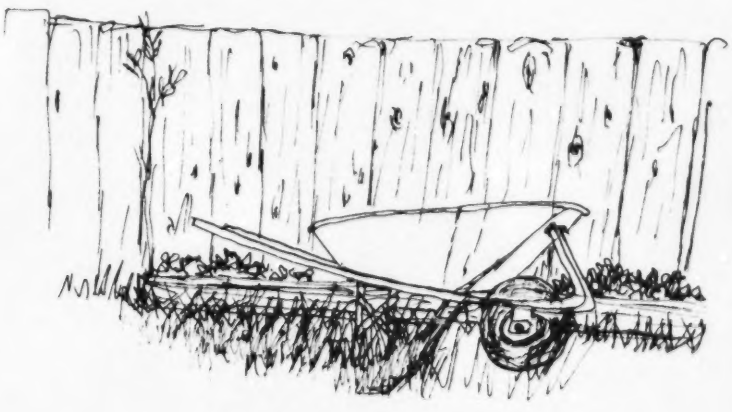


*Make weekly observations in your journals. In which bed did the beans sprout first? Grow fastest? Have less damage from insects and disease? Flower first? Taste the best?

You could post a chart like this on your garden bulletin board:

DATE	HEIGHT OF BEAN PLANT IN INCHES			AMOUNT OF INSECT DAMAGE (SCALE 0-5)			DATE OF FIRST FLOWERING			LENGTH OF MATURE BEAN IN INCHES			TASTE (SCALE 0-5)		
	BED			BED			BED			BED			BED		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
1/1															
1/8															
1/15															
1/22															
1/29															
2/5															
2/12															

Try other plant combinations too! The list of "companions" should provide lots of ideas.

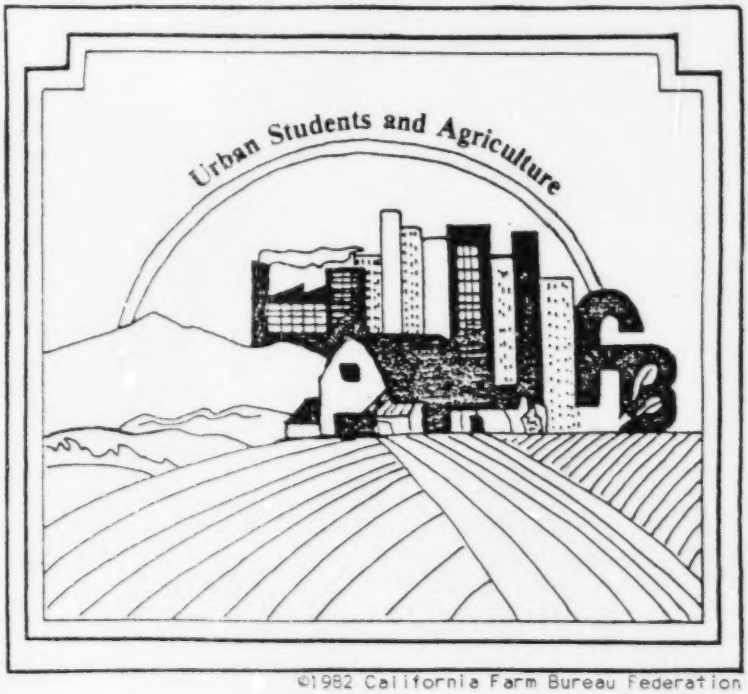


Additional Resources

FARM BUREAU'S AGRICULTURAL EDUCATION PROGRAM

The California Farm Bureau has established a unique program to help inform students and teachers of the important role agriculture plays in our economy. Together with the San Francisco Unified School District, a model plan for incorporating Farm Bureau's "Urban Students and Agriculture" Program into the curriculum is being developed and implemented.

The program has been tested primarily in San Francisco and is now being offered to other school districts throughout California. Various areas that currently are planning Farm Bureau's activities include Glendale, San Diego, Sacramento and Los Angeles.



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Farm Bureau's Ag Education activities include:

- Farm Day Programs
- Field Trips to the Country
- Teacher Tours to Farms
- Rural/Urban Exchange
- Farmer in the Classroom
- Unit Study on Agriculture
- Teacher Workshops on Agriculture
- Career Opportunities in Agriculture and Agri-Industry
- University Course: "Agriculture in the Urban Classroom"

If you would like to participate in Farm Bureau's Program or would like further information, contact:

CALIFORNIA FARM BUREAU FEDERATION
AGRICULTRUAL EDUCATION PROGRAM
1601 EXPOSITION BOULEVARD
SACRAMENTO, CALIFORNIA 95815